TECHNOLOGY

Grinding and Finishing

september 1957

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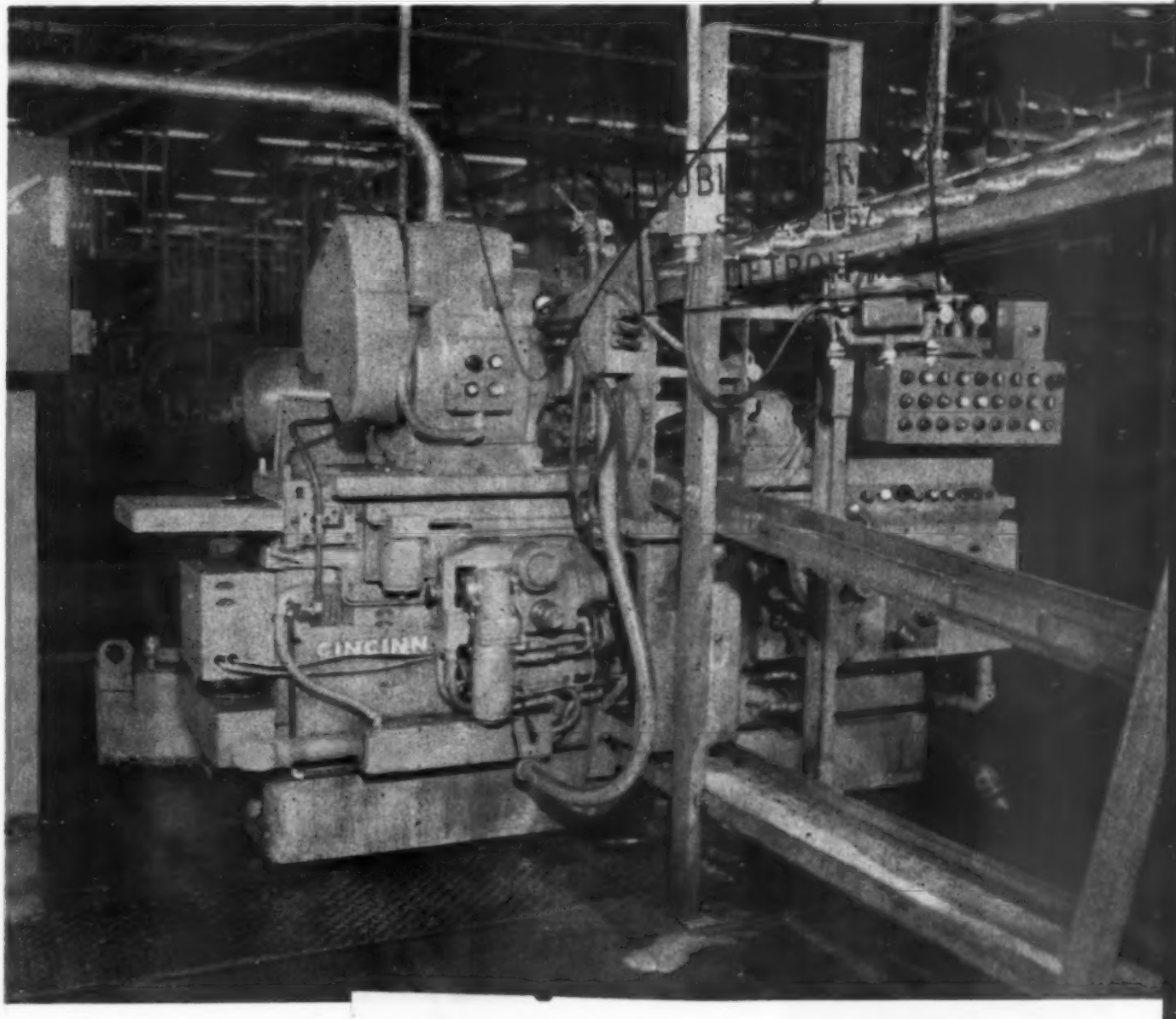
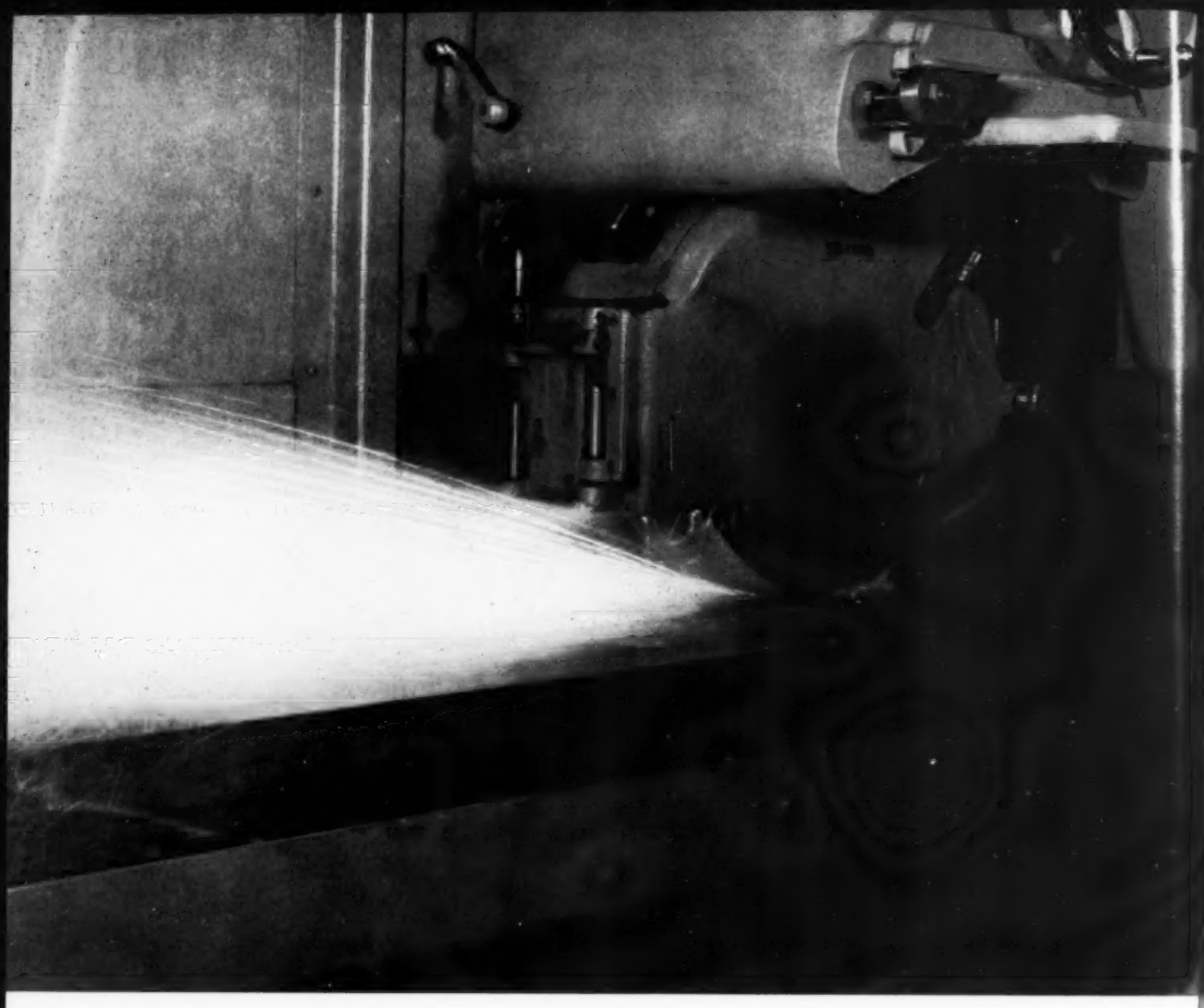
How to Take Care of Your Grinding Spindle —page 36

Latest Techniques in Titanium Grinding —page 39



Fully automated stem pinion grinder at Ford
—see page 1

a hitchcock publication



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Sept. 1957

grinding and finishing

the magazine of abrasive metalworking operations

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BPA

FEATURE ARTICLES

Automated Grinding at Ford Sterling 27
Ford's new chassis parts plant is loaded with the latest in grinding automation. By Jack Kenyon.

How a Chicago Stainless Distributor Uses Wet Abrasive Cutting 34
Twin-head rail mounted machine has improved service to Chicago Steel Service's customers for stainless plate.

What's Involved in Proper Care of Grinding Spindles 36
The precision grinding spindle, like the human heart, ought to have good treatment and an occasional checkup.

Titanium Grinding 39
To conquer this troublesome metal, best approach is to set up experimental test, says Thompson Products' Larry Hays.

New Standard Practice Recommendation for Grinding Wheels 48
Standard shapes and sizes recommended for industry.

How to Get the Most from Hand-Applied Dressers 52
Surprising improvement in performance follows proper selection, techniques of use. By R. S. McConnell.

Mandrel Deflection: Important Factor in Hole Grinding 62
Bending can be analyzed as simple beam. By J. A. Yalmokas.

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COVER: THIS STEM PINION GRINDER at Ford Motor Company's new Sterling chassis parts plant may qualify for the title of World's Most Fully Automated Centertype Grinder. It has fully automatic loading and unloading, feedback controlled table positioning and size control of parts, automatic wheel balancing and dressing. Story on this integrated plant begins on page 27.

CINCINNATI
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give you a strong secondary line of

Whatever is good for the cutting edge of your expendable tools is good for production. And CINCINNATI® Cutter and Tool Grinders are certainly good for the cutting edges of all types of milling and die sinking cutters, reamers, hobs, taps and others. There are 5 machines in the Cincinnati group. They constitute an exceptionally strong secondary line of production equipment for machine tools of all types. Sweet's Machine Tool File contains brief specifications, and complete data may be obtained by writing for catalogs.

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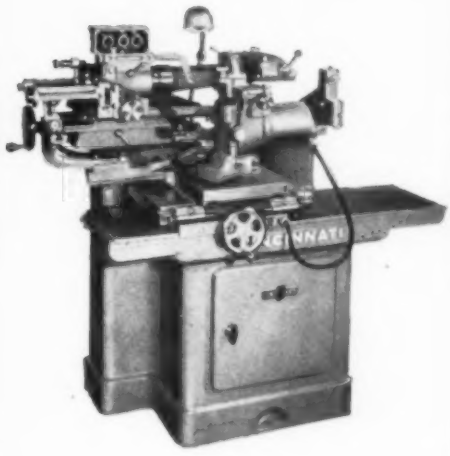
No. 2 FILMATIC—For grinding the majority of cutters used in metalworking shops of all sizes . . . milling cutters, reamers, hobs, taps, planer tools. Host of attachments available, including Radius Grinding; Face Mill; Indexing for Workhead; Dust Exhaust; Spring Chucks and Collets. Capacity: 10" swing over table, 27" between centers. Catalog No. M-1914-2.

No 1.—A companion machine for the No. 2, or in shops using only small- to medium-sized cutters, the No. 1 will be your first choice. Timesaving features include anti-friction table slide; eccentric wheelhead swivel mounting; reversible motor built into wheelhead; three-way controls. Capacity: 8" swing over table, 15" between centers. Catalog No. M-1852-1.

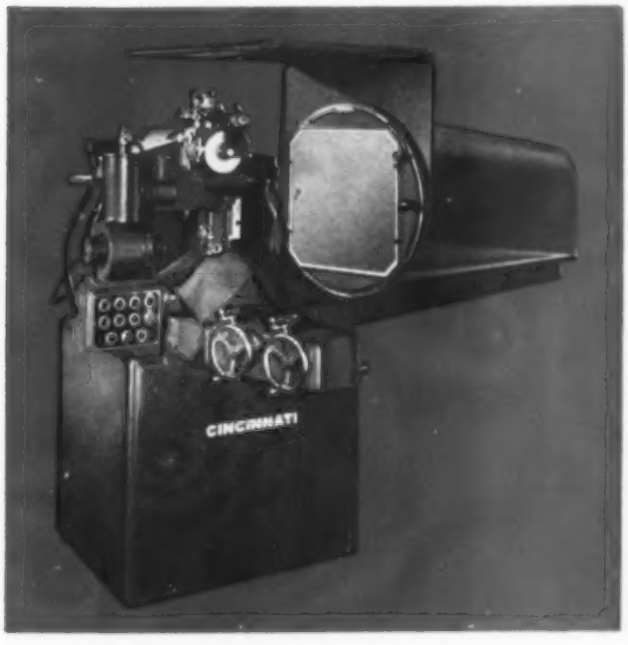
ol Grinders

ne of production



CONTOUR—This machine offers a big saving for shops having a volume of form milling operations. It grinds form milling cutters on the periphery of the teeth to a definite cutting clearance chosen for the work material. Contour ground cutters produce a greatly superior finish at a higher feed rate. Catalog No. M-1918-1.

MONOSET—For sharpening, repairing and making small cutters including countersinks, those required for die sinking, and other unusual shapes. Because of the universal construction, most jobs can be completed in one chucking. Built-in spiral lead mechanism generates infinitely variable helices, right- or left-hand, $1\frac{1}{8}$" min. lead. Catalog No. M-1591-3.



PROJECTO-FORM—For grinding small, accurate profile shapes on flat form cutters, lamination die parts and similar components. This machine combines grinding with an optical comparator unit. Work profile is enlarged 20 X on ground glass viewing screen directly in front of operator. Master drawings made on Layout Scribing Machine. Catalog No. M-1612-5.

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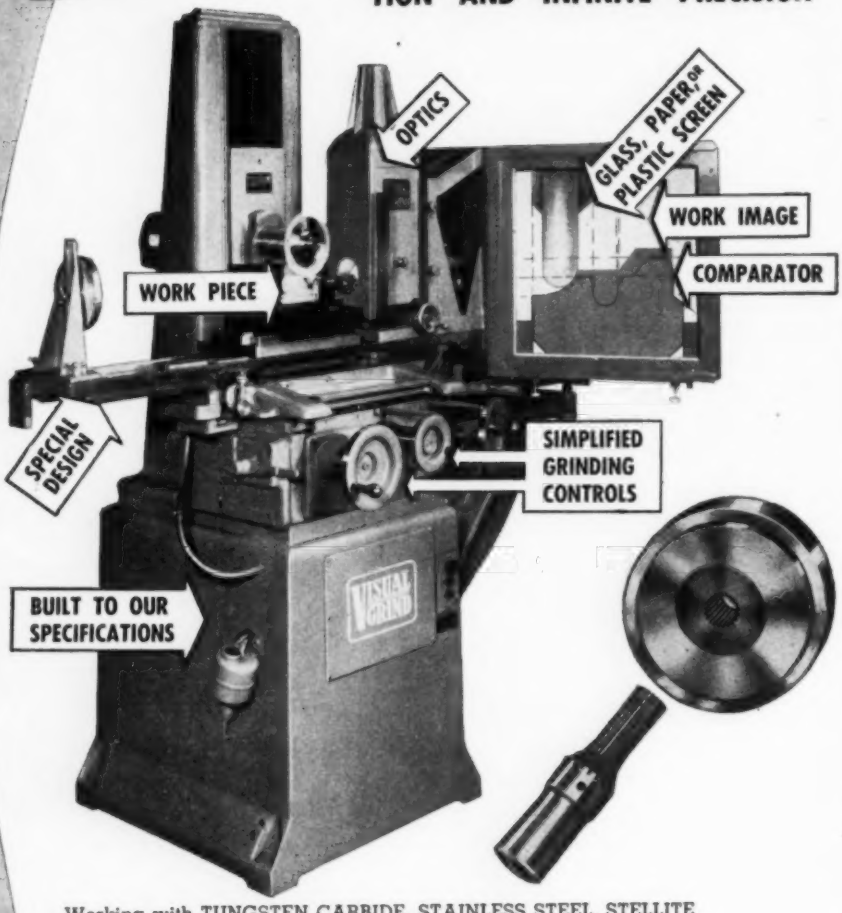

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Letters to the Editor

Safety Page Makes A Hit

We should like to tell you how much we appreciate this publication. It helps to keep us right up-to-date with developments and we find the material it contains to be very thought stimulating.

We have made a special point of bringing your magazine to the notice of good friends in industry and also in official circles.

Your series on "Grinding Safely" has excited the interest of the Danish Factory Inspectorate. This organization is setting up, in Copenhagen, a permanent exhibition of workshop safety methods which will also illustrate and show examples of the type of accidents that can occur through neglect, etc.

We are wondering whether you can let us have some copies of the series, possibly, together with enlargements of the photographic illustrations.

If you can help us we will, of course, ensure that your publication is given credit for any material used. We think this may well prove a very effective way of bringing your magazine to the notice of a large section of technically minded people in this country.

In conclusion, we would stress that English is widely understood and read here—so you need not fear that your efforts will be wasted.

J. M. Todd-Moir
Chr. Schmidt & Co.
Copenhagen, Denmark

Standard Time Data

Please send me a copy of "Developing Standard Time Data For Grinding Operations" for which I enclose my check.

I have found your magazine

(continued page 8

(PATENT APPLIED FOR)

NEW

MANHATTAN SAFETY BACK FLARED CUP

Not simply a new safety "feature" . . . not merely a design "improvement." Here's a *totally new concept* of flared cup wheel design *and* construction . . . developed by Manhattan engineers to give the greatest safety and performance advantages possible for flared cup wheel users. Manhattan's revolutionary SAFETY BACK Flared Cup puts portable wheel *safety* where it counts the most—in *original* strength and breakage resistance!

SAFETY BACK makes obsolete ordinary safety features such as anchor bushings, safety rings, special hub mountings, or revolving cup guards. With SAFETY BACK, steel covers the *entire* back of the flared cup . . . extends down the side to offer a degree of reinforcement and breakage resistance never before possible!

NO OTHER WHEEL—AT ANY PRICE—OFFERS THESE EXCLUSIVE FEATURES

- **Greatest Initial Strength**
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- **Improved Mounting Base**
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- **Requires No Adjustment**

Only SAFETY BACK gives you these features—*plus* Manhattan's custom-engineered abrasive bond for *faster* removal of *more* metal on your particular job—at no additional cost! For "More Use per Dollar" in portable grinding operations, you can't get a faster cutting, longer lasting—*safer* wheel than MANHATTAN.

Let a Manhattan abrasive wheel engineer show you the advantages of SAFETY BACK Flared Cups, and other types of Manhattan high speed, heavy duty abrasive wheels. Write for Bulletin 7157.

RM-782

GRINDING WHEEL INSTITUTE MEMBER

WRITE TO THE ABRASIVE WHEEL DEPARTMENT

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Stuart CODOL

LIQUID GRINDING COMPOUND

Disc grinder (right) hogs off approximately .035 in. from rough Alnico castings. Small segmented bar-type magnets are ground at a high rate of production on an automatic double-spindle disc grinder. Stuart's Codol helps maintain profitable production . . . covers machine ways and moving parts with a rust-inhibiting film of light petroleum oil.

Continuous grinding is more efficient with Codol as it resists overheating, minimizes wheel loading . . . reduces downtime for sharpening the wheel.

Codol's stability prolongs its effectiveness, reducing cutting oil costs. More than 15,000 gallons of a 3.5 per cent Codol and water solution are circulated from this outdoor reservoir to a battery of grinders in the Spaulding Works of Crucible Steel Company.

How you can use Stuart's CODOL to step up production and reduce costs!

Take advantage of today's improved wheel bonds and more powerful grinding machines by using Stuart's Codol Liquid Grinding Compound . . . a carefully formulated combination of petroleum oil and emulsifier. To give you maximum on-the-job economy, Codol permits faster stock removal, using heavier feeds and harder, larger wheels. For Codol *lubricates* as it cools, prevents metal flow and wheel loading, and eliminates stress failure from heat generated by grinding. On precision work, Codol guards against heat distortion and assures maximum dimensional control . . . especially important when grinding thin-walled parts. Break the heat barrier and upgrade performance on your cylindrical, centerless, and surface grinding operations with Stuart's Codol!

"Rust problems eliminated with Stuart Codol," that's the report from the Spaulding Works of Crucible Steel Company, Harrison, N. J.—makers of widely used Alnico magnets. Experience there on several different grinding machines has proved that Codol's high detergency, lubricity, cooling, and rust-inhibiting characteristics save money by reducing machine wear . . . prolonging wheel life . . . providing good stock removal conditions for rough- and finish-grinding operations.

Since these grinders are serviced from a central reservoir, a highly developed water-mix compound is important for over-all production efficiency at Crucible.

Codol's carefully balanced surface tension floats chips away from the wheel, work, and machine . . . provides a protective film of lubricating oil for machine ways, guide bars, and moving parts . . . gives two-way cooling action that assures efficient grinding at high production rates.

Crucible Steel Co. eliminates rust, reduces machine wear, grinding with Stuart's Codol!

Codol keeps wheel free-cutting on this high-production, single-pass grinding operation, with .0025 in. downfeed per revolution.

Template checks accuracy of convex poles after grinding ends of rough Alnico castings. Codol keeps wheels sharp and free-cutting when "hogging off" stock on the disc grinder.

Phone your
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Arrange now to test Stuart's Codol on your difficult grinding jobs.

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7" guard and cut-off wheel

Sander

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Letters . . .

most interesting and informative. Keep up this excellent work.

William R. Short
Supervisor of
Industrial Engineering
Electrol, Inc.

We would very much appreciate your sending to us reprints of Parts No. 1, No. 2, and No. 3 of your series of "Developing Standard Time Data for Grinding Operations," which has appeared in your magazine and is of a great deal of interest to us.

Armand J. Ledoux
Executive Vice President
The Black Rock Mfg. Co.

Would you please send me either a copy, tear sheets, or a reprint of your June article, "Part 4—Wheel Selection and Wheel Forming" on Surface Grinding, Horizontal Spindle—Reciprocating Table.

I have all the other articles in this series, and would like Part 4 to make it complete. I enjoy reading your articles, such as these and the "Developing Standard Time Data" series especially. Thank you very much.

Kenneth K. Schmidt
Cost Estimating Section
Remington Rand Univac

I would be interested in obtaining a copy of the reprints on "Centerless Grinding" published in 5 articles ending June 1956, if the booklet is still available.

Another article entitled "Developing Standard Time Data for Grinding Operations" would prove beneficial in my work.

I shall be glad to pay any fee these two booklets may entail.

H. V. Lambert
The Taft-Peirce Mfg. Co.

Would you please send me a copy of "How Grinding Standards Are Established With Standard Data?"

I missed seeing the magazine issue which contained the article. The information should be very useful in estimating grinding costs and planning new grinding facilities.

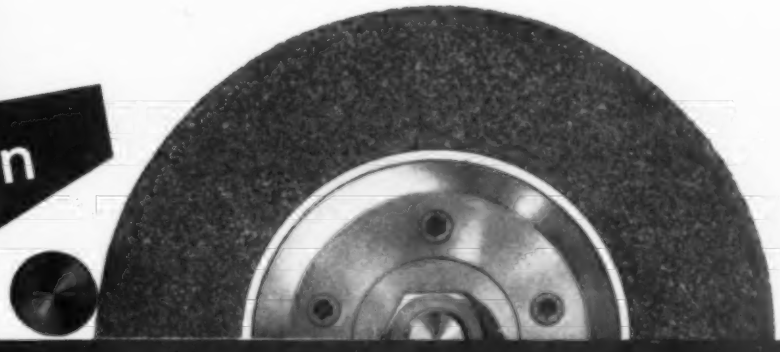
John W. Love
Methods Engineer
Aircraft Engine Div.,
Ford Motor Co.

WALTHAM "Variable Density"

CYLINDRICAL GRINDING WHEELS

Reduce Cylindrical Grinding Costs

PRODUCE UNIFORM Grinding Action



ALL THE WAY TO THE FLANGES

DRESSING

All the way to the flanges — more pieces per dress as Variable Density **grinding action is uniform all the way down.**

CORNERS

Uniform action all the way to the flanges — sharp corner holding, as Variable Density adjusts for changing contact area.

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Uniform micro-inch readings all the way down to the flanges.

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Many grinding departments have found Waltham 14A60Z-K17V2 an exceptionally good wheel for Cylindrical Grinding. Note: 17 indicates Variable Density with 7 structure.

Waltham Variable Density Wheels are made from 16" through 36" as operations require.

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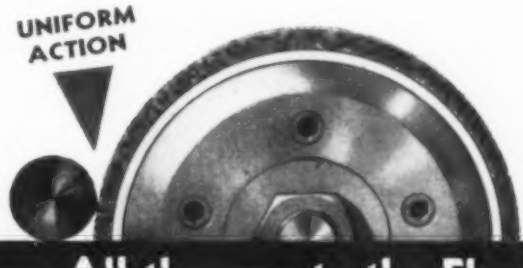
As Grinding Wheels Wear Down the constantly smaller diameter creates two changes in grinding action —

the surface feet per minute gradually become lower,

the arc of contact between wheel and work gradually becomes smaller.

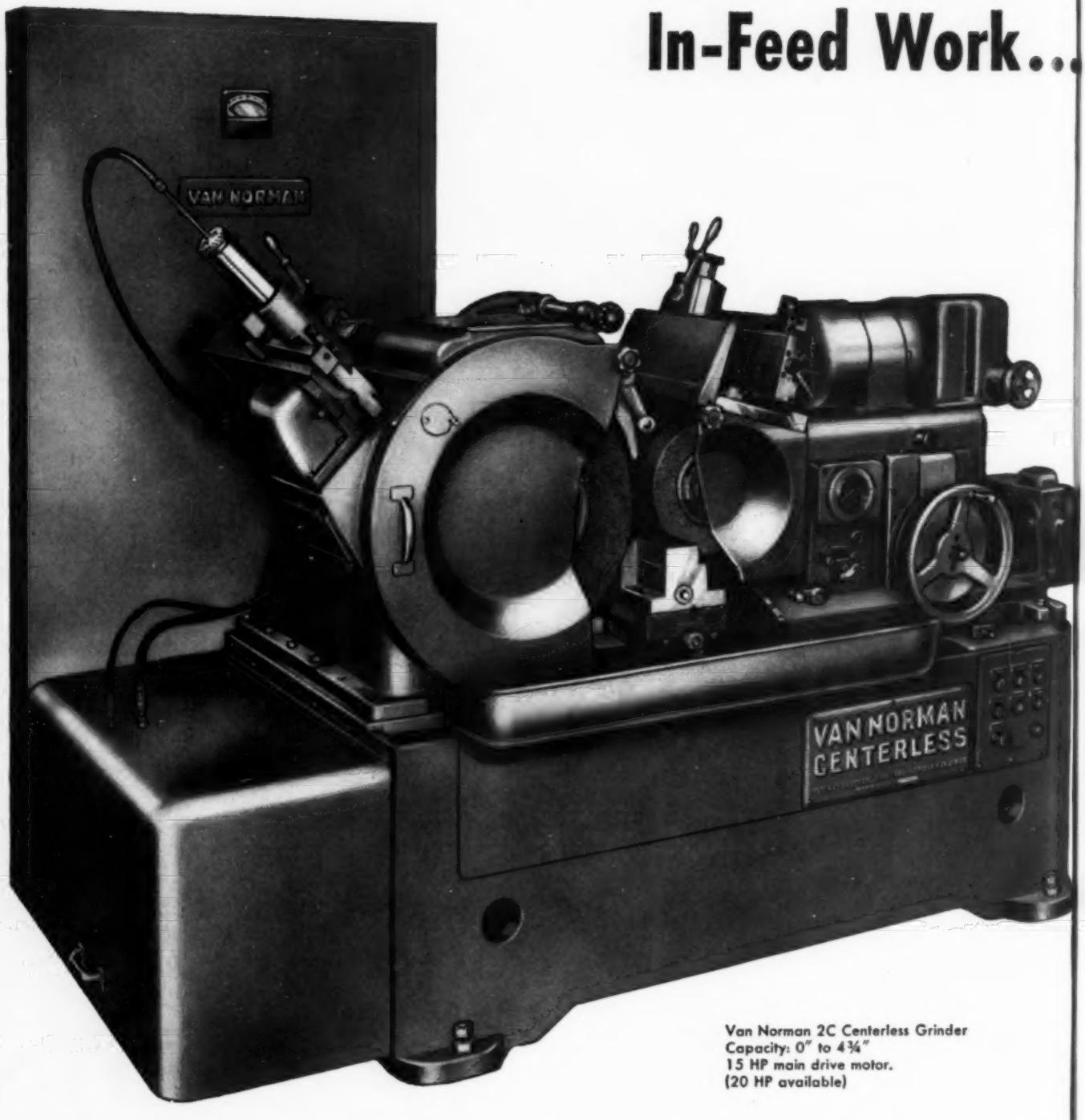
Waltham Variable Density automatically compensates for these ordinary wheel conditions, with uniform action all the way to the flanges.



Yes — All the way to the Flanges!

Waltham Grinding Wheel Company • ESTABLISHED 1880 WALTHAM, MASSACHUSETTS

Now you can do: Thru-Feed Work...
In-Feed Work...



Van Norman 2C Centerless Grinder
Capacity: 0" to 4¾"
15 HP main drive motor.
(20 HP available)

VAN NORMAN MACHINE

MANUFACTURERS OF — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.

...Form Grinding...Profile Work...

with ONE

VAN NORMAN 2C
Centerless Grinder

Featuring a 15 HP main drive motor which provides ample power for every grinding job, the Van Norman 2C Centerless Grinder actually gives you the facilities of *3* centerless grinders . . . standard grinding for thru-feed work . . . standard grinding for in-feed jobs and, equipped with crush dressing attachment, form grinding and profile work.

Get complete details on this newest in the expanding line of Van Norman grinders. Write, wire or telephone today for descriptive catalogs.

Check these features of the Van Norman 2C Centerless Grinder:

- √ Hard chrome plating of regulating wheel slide preserves original factory built-in accuracy.
- √ Grinding wheel and regulating wheel spindles are of a unit type construction . . . totally enclosed with double-row super-precision bearings, sealed and lubricated for life — assuring rigidity and accuracy previously unobtainable in centerless grinding, vibrationless operation.
- √ Spindles require no warm-up period, eliminating "creep."
- √ Infinitely variable regulating wheel drive.
- √ Combination straight and profile hydraulic wheel dressers for each wheel.
- √ **Crush dressing attachment**

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Don't wait . . . for extra profit install a Van Norman machine now! They are available in many purchase plans . . . Outright sale . . . Purchase on conditional sales contract up to five years . . . Pay as you depreciate . . . up to 10 years.

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Vulcanaire

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Using a jig borer index table with the Vulcanaire 5 indexing holes and 35 locating and clamping holes were JIG GROUND in place. Result — eliminated all close locating and dowelling of individual parts and of course hours of time.

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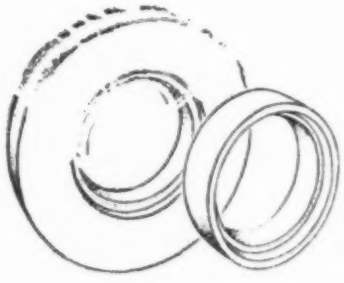
grinding and finishing

A HITCHCOCK PUBLICATION

hitchcock publishing company
wheaton, illinois

Jim Lewis, of W. Lewis Sales Co., Cleveland, typical Bay State distributor, says," I try to figure out how I'd meet my customers' payrolls and still make a profit. That way I get ideas I'd never have if I just concentrated on my own selling problems."



The "hole" on the right is all they throw away now.

He put one wheel to work on two machines!

Ed and John Menhart, of Cleveland's Micro-Plane, Inc., were well satisfied with the 24" x 4" x 12" Bay State wheels on their big Hanchett horizontal surface grinder. They were the only wheels they'd found in 8 years that could handle the tremendous variety of work that went through their shop.

But . . . because surface speed dwindled as the wheels wore down, grinding efficiency naturally dropped, too. This bothered Jim Lewis, the Bay State distributor who specified the wheels, because he hates to see his customers throw away "anything but the hole" in a grinding wheel.

Lewis got together with the people in Bay State's Cleveland office and figured out a solution. At their suggestion, Micro-Plane adapted a smaller Hill-Acme surface grinder that not only put the half-used wheels efficiently and profitably to work but also substantially reduced wheel costs because they no longer had to buy wheels for the Hill-Acme.

If you would like to supplement your engineering staff with an abrasive specialist like Jim Lewis, you'll find it well worth your while to talk to the Bay State man in your area. He's trained to find *practical, profitable* solutions to your grinding problems.

BAY STATE WHEELS of PROGRESS

BAY STATE ABRASIVES

Bay State Abrasive Products Co., Westboro, Massachusetts.
Branch Offices and Warehouses: Bristol, Conn., Chicago, Cleveland, Detroit, Pittsburgh. *Distributors:* All principal cities. Bay State Abrasive Products Co. (Canada) Ltd., Brantford, Ontario.

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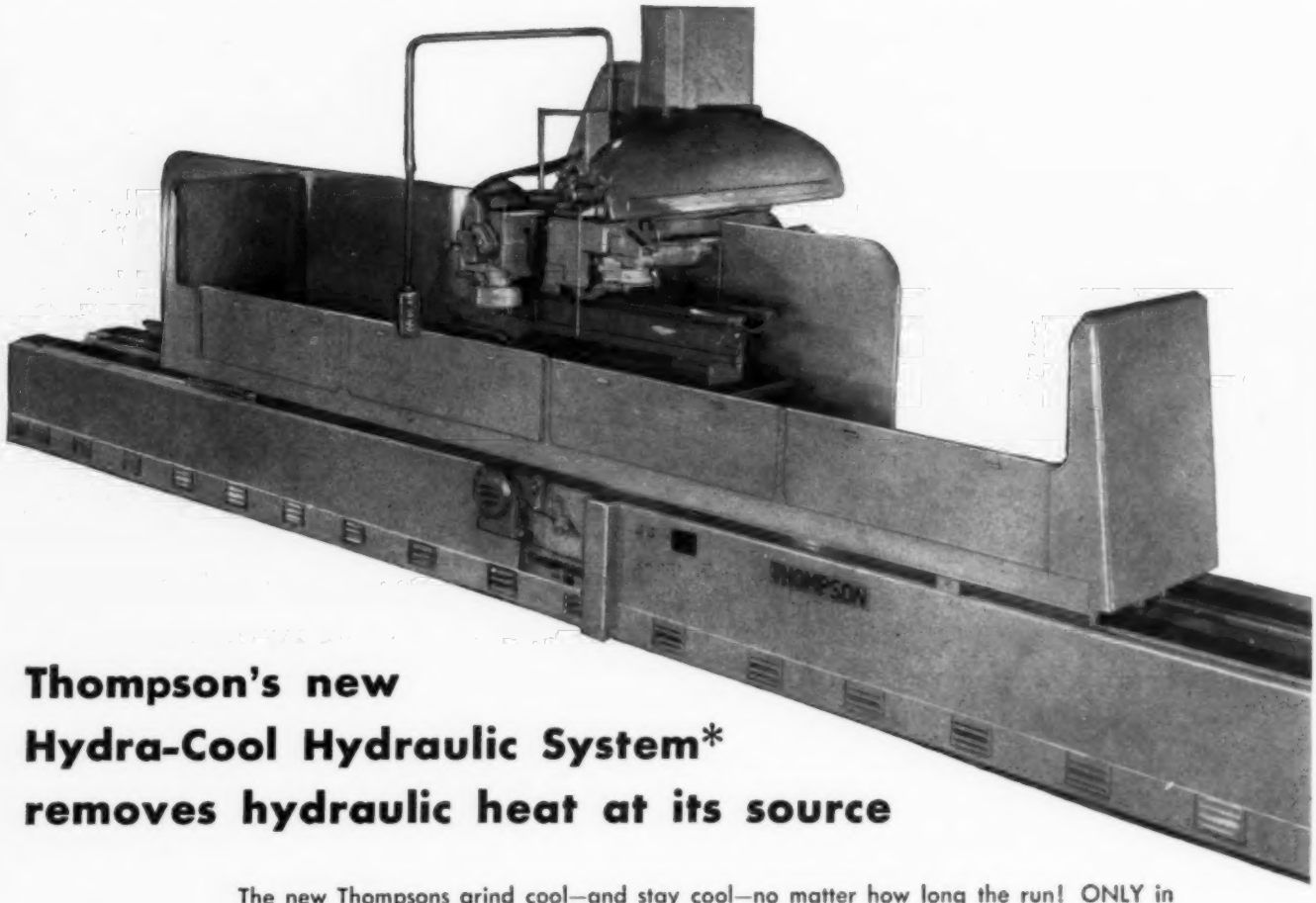
HYDRA-COOL



Thompson's new Hydra-Cool Hydraulic System* removes hydraulic heat at its source

The new Thompsons grind cool—and stay cool—no matter how long the run! ONLY in this new hydraulic system can you get these important, exclusive advantages—

- Hydra-Cool eliminates heat damage to the hydraulic seals, valves, controls and pump.
- Hydra-Cool will not break down the additive-type hydraulic oils—sludge will not form in the Hydra-Cool System.
- Hydra-Cool eliminates the usual lengthy warm-up period required to bring production surface grinders up to working temperature.
- Hydra-Cool saves you money on power costs.

Hydra-Cool is standard on all Thompson surface grinders 40 inches and up in work length AT NO EXTRA COST.

*Pat. Applied For

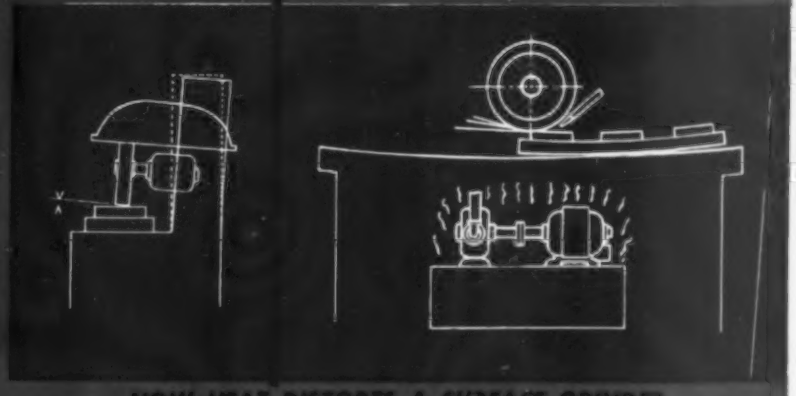
"KEEP Thompson IN MIND FOR THAT DAILY GRIND"

Constant

ASSURES ACCURACY

HEAT DISTORTION IS ELIMINATED IN THOMPSON SURFACE GRINDERS

As shown at right, heat distorts the column of a surface grinder from its true vertical alignment, causing the column to bend back from the work table. This further destroys the machine's accuracy.



HOW HEAT DISTORTS A SURFACE GRINDER

Coolant, splashing and evaporating on the work table, cools the top surface, which contracts. Hydraulic heat, ranging from 50° to 70° above ambient temperatures, heats the bottom surface of the table, which expands. This causes the whole table to become concave. As shown in the exaggerated drawing above, any work being ground during this distortion is ground too heavily on the ends of the table and not enough in the middle. Surface flatness and parallelism cannot be maintained.

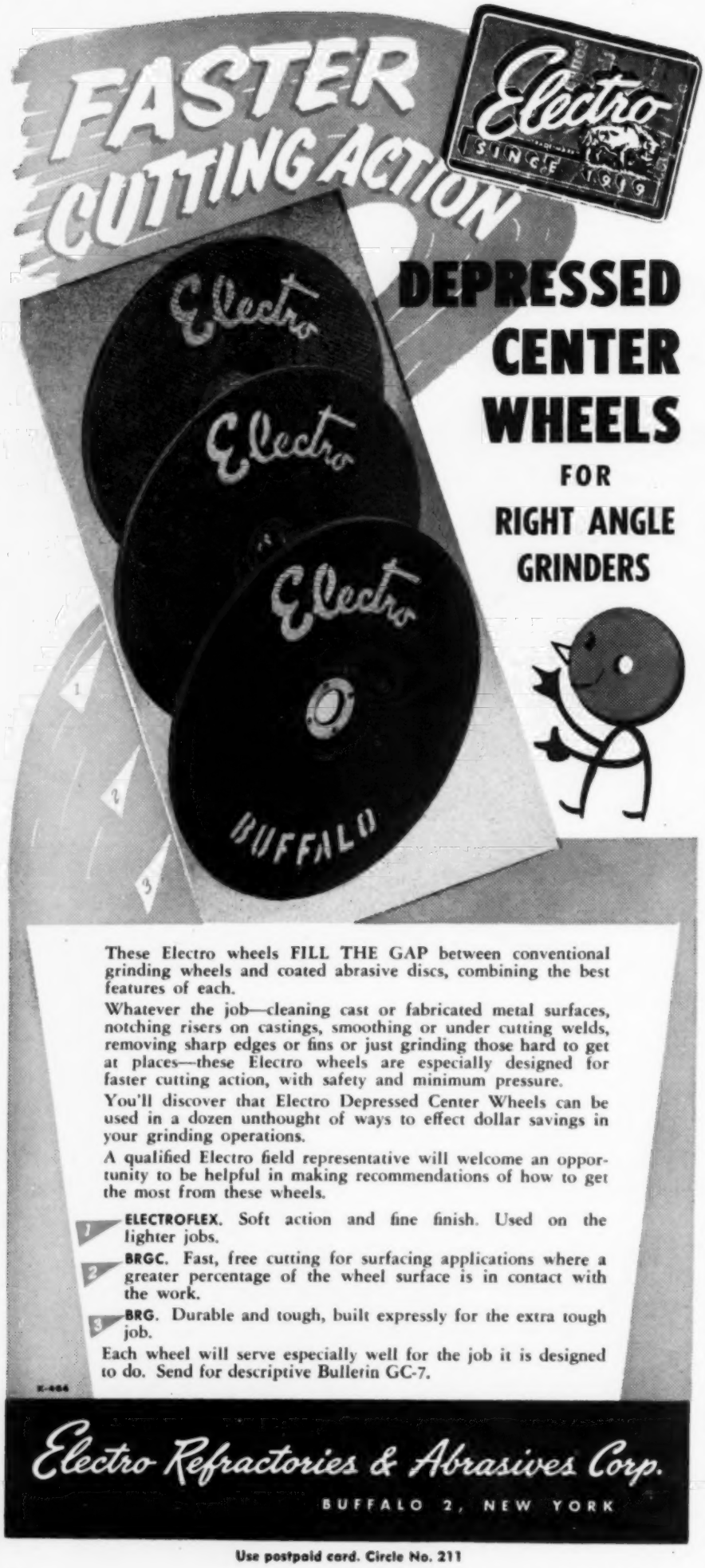
No more than a few degrees rise above ambient temperature is found in the Hydra-Cool System! Distortion is eliminated —accuracy is assured.

SEND FOR DESCRIPTIVE HYDRA-COOL FOLDER

The Thompson Grinder Co.
16 Zeischler Street
Springfield, Ohio, U. S. A.

Thompson
SURFACE
GRINDERS

Use postpaid card. Circle No. 210


FASTER CUTTING ACTION
Electro
SINCE 1919
DEPRESSED CENTER WHEELS
FOR RIGHT ANGLE GRINDERS
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BUFFALO
1
2
3
These Electro wheels FILL THE GAP between conventional grinding wheels and coated abrasive discs, combining the best features of each.
Whatever the job—cleaning cast or fabricated metal surfaces, notching risers on castings, smoothing or under cutting welds, removing sharp edges or fins or just grinding those hard to get at places—these Electro wheels are especially designed for faster cutting action, with safety and minimum pressure.
You'll discover that Electro Depressed Center Wheels can be used in a dozen unthought of ways to effect dollar savings in your grinding operations.
A qualified Electro field representative will welcome an opportunity to be helpful in making recommendations of how to get the most from these wheels.
1 ELECTROFLEX. Soft action and fine finish. Used on the lighter jobs.
2 BRGC. Fast, free cutting for surfacing applications where a greater percentage of the wheel surface is in contact with the work.
3 BRG. Durable and tough, built expressly for the extra tough job.
Each wheel will serve especially well for the job it is designed to do. Send for descriptive Bulletin GC-7.
X-484
Electro Refractories & Abrasives Corp.
BUFFALO 2, NEW YORK
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Industry Observer

• *Assault on the infinitesimal*—Latest news in the battle for an accuracy of one-tenth of a millionth of an inch, a joint government-industry metrology study begun recently, is that 14 companies are participating in the program. Initial cost of the studies is modest; Congress has appropriated $75,000 to be used by the Bureau of Standards in the effort. But the goals are far-reaching in importance, including development of master gage blocks that can be stabilized reliably to one tenth of a millionth, and improvement of present interferometers, or light-wave measuring instruments, to give that accuracy. Companies now participating in the measurement push are: Dearborn Gage, DoAll, DuPont, Ford Motor, General Electric, Greenfield Tap & Die, Hughes Aircraft, IBM, New Departure Division of General Motors, Pratt & Whitney, Sheffield, Taft-Peirce, Timken, and Van Keuren.

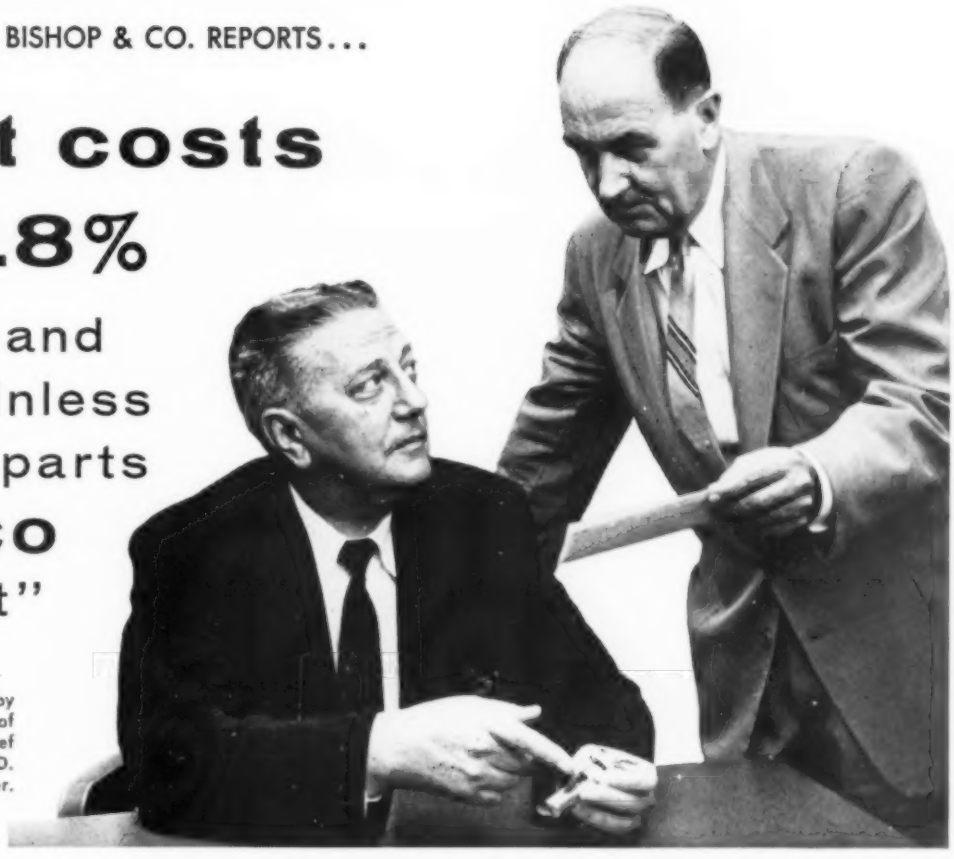
• *Industry-wide cooperation* is needed if the standard wheel shapes and sizes recommended by the Grinding Wheel Institute, official wheel manufacturers' association, are to become practical realities. Some rather surprising things came to light in managing editor Jack Kenyon's research into the rather poor acceptance of standard wheel shapes and sizes by builders of grinding machines. On the surface, it would appear that the builders were hostile to the idea of standardization, but probably this isn't the case. More likely, the builders will simply have to be educated to the principles and practices of standardization. It's all to the wheel users' benefit that standards be adopted throughout

(continued page 18)

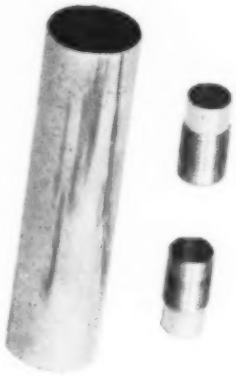
THE CHIEF ENGINEER OF J. BISHOP & CO. REPORTS...

"We cut costs 98.8%

by deburring and polishing stainless steel tubular parts with ALMCO equipment"



SAVINGS OF $6,917.50 PER YEAR by controlled barrel finishing is the topic of discussion between J. H. Gettig, Chief Engineer of J. Bishop and Co., and O. D. Ladley, Almco Eastern Branch Manager.



HALF A MILLION delicate parts for recording instruments and fountain pens are deburred and polished each year at J. Bishop & Company of Malvern, Pennsylvania. Each must meet rigid requirements in uniformity of size, smoothness and high polish.

A costly process? Yes, when you consider the way Bishop used to finish them by machine reaming, hand scrapers, wire brushes and belt polishers.

Today this plant uses an Almco Model DB-200 finishing barrel, which gives three important advantages: (1) High volume, low cost deburring and finishing, (2) precise control during finishing process, (3) product improvement.

Here's how controlled barrel finishing worked out for J. Bishop & Company. They cut finishing costs by 98.8% ... practically eliminated rejects ... raised average output from 200 parts to 6000 parts per hour. Cost per unit for finishing has been cut from .014¢ to .00016¢. Annual savings total $6,917.50.

Chief Engineer J. H. Gettig sums it up this way, *"Our decrease in costs and our product improvement leaves no basis for comparison."*

Almco equipment is also used throughout the world for descaling, grinding, work-hardening, rust-inhibiting and other deburring and finishing operations. Equipment is available for small and large parts, high or low volume work. Each is designed to handle ultra-low microinch surfaces and close tolerance radii.

LEARN HOW MODERN BARREL FINISHING CAN IMPROVE YOUR PRODUCT

Almco's new, technician-staffed lab in Albert Lea, Minnesota can help you with your product parts. We will examine your product parts, run them through tests, and come up with the answers you want. For example — where you can save finishing costs, how you can improve product quality and appearance, what method is best for your operation.

Why not send us your sample parts? Enclose specifications on the results you want. Or write us on your company letterhead requesting an Almco engineer to call on you.

SEND FOR YOUR FREE HANDBOOK ON BARREL FINISHING

52 pages of facts and processes on barrel finishing. Shows typical installations, how to select the proper finishing barrel. Includes detailed cost chart on finishing of typical parts. Send for your free copy today.

ALMCO

DIVISION OF QUEEN STOVE WORKS, INC.

139 Marshall Street • Albert Lea, Minnesota

Sales Engineering Offices in Chicago, Detroit, Los Angeles, Newark, New Haven, Philadelphia and London, England

PART OF A HALF MILLION ANNUAL OUTPUT, this batch of delicate instrument parts is being run in an Almco DB-200 barrel finishing machine.

Use postpaid card. Circle No. A1

GRINDING and FINISHING

During 1956 the diamonds imported and processed by Norton for industrial purposes were f

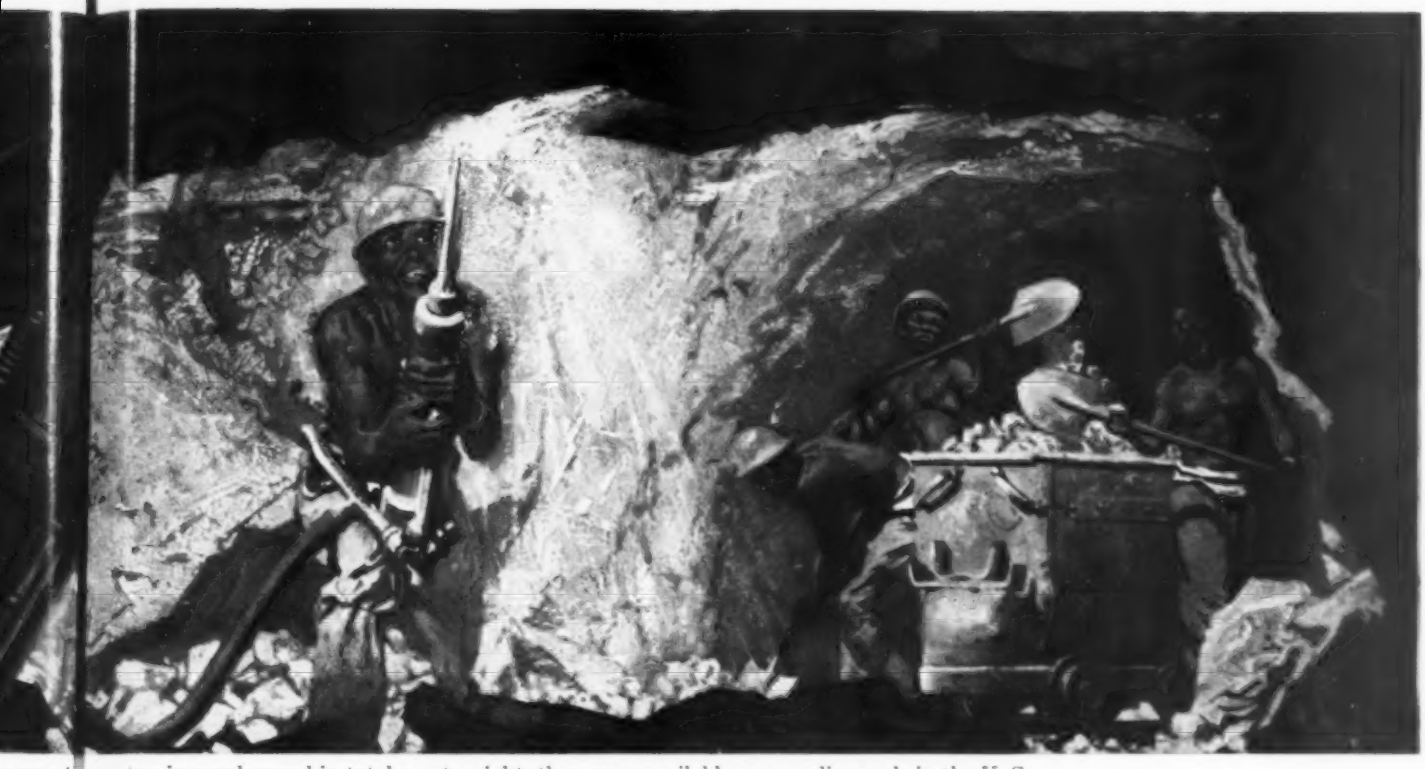
From diamond mines..

List Price $25,408 — and well worth it! This Norton diamond wheel, built for a prominent ceramics manufacturer, precision-grinds extremely hard parts. Its ability to last so much longer and grind so much better than other wheels more than justifies its first cost.

For Internal Grindin Norton makes these sma est diamond wheels, t gether with every oth size and type required f surface or cylindrical grin ing, sharpening, sawing cutting-off. And each whe has the long-lasting exce lence that assures the us steady profits.

Replacing Four Separate Grinders, this Norton CM-1 multi-wheel grin ing machine enables one operator to grind four diameters simultaneousl Besides freeing three operators for other jobs it reduces capital inves ment, production time and operating costs. Only Norton offers suc long experience in grinding wheels and grinding machines.

Making better products..



s were f greater, in number and in total carat weight, than were available as gem diamonds in the U. S.

. . . *Industry's Crown Jewels*

The most beautiful and valuable gems ever used for personal adornment are not the only diamonds mined.

Others, known as bort, are vitally important to a wide range of industries. Diamond bort, composed of commercial grade diamonds and of fine-quality diamond fragments, is processed into grinding wheels that grind materials which cannot be ground in any other way.

Norton pioneered in this processing. Leadership in improving every type of grinding wheel as well as abrasives has enabled great advancement in diamond wheel manufacture and performance — including the introduction of major bond types and successfully meeting the grinding problems of new metals, alloys and materials.

As a result — and like the entire line of Norton abrasives, grinding machines, refractories and new electrochemical materials — Norton diamond wheels live up to a reputation for exceptional value.

That is why they are recognized as the *Crown Jewels* of industry for the grinding of carbides, ceramics, stone, glass, electronics and all diamond wheel operations.

NORTON
ABRASIVES

"Hot Rods" Heat Longer and Better. Norton CRYSTOLON* (silicon carbide) heating elements bring many advantages to electric furnace users. Lasting up to three times longer than other nonmetallic elements, "Hot Rods" heat more uniformly and greatly reduce maintenance.

Across the world and still expanding

Abrasive and Grinding Wheel Plants — Worcester, Mass.; Santa Clara, Calif.; Hamilton, Ontario; South Africa; England; France; Germany; Italy; Brazil.

Behr-Manning Plants — *Coated Abrasives and Behr-cat Tapes* — Troy, N. Y.; Canada; Australia; France; Northern Ireland; Argentina; Brazil.

Electric Furnace Plants — Huntsville, Alabama; Chippawa, Ontario; Cap-de-la-Madeleine, Quebec; Brazil.

Grinding and Lapping Machine Plant — Worcester, Mass.

Refractories and Electro-Products Plant — Worcester, Mass.

Norton Pike Plant — *Sharpening Stones* — Littleton, New Hampshire.

Bauxite Mines — Bauxite, Arkansas.

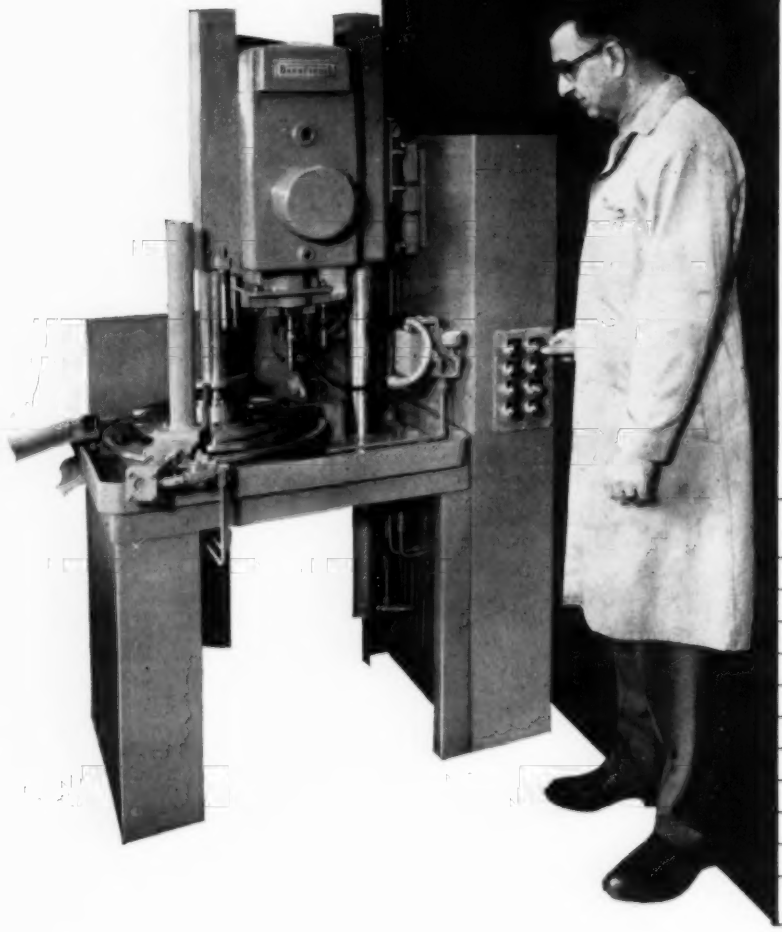
General Offices: Norton Company, Worcester, Mass.

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

. . . to make your products better

new automatic production-type honing machines

for bores up to 2" diameter



A new series of Single Spindle Vertical Honing Machines, designed with complete automation for handling parts up to 2" diameter, is being introduced by BarnesdriL engineers. These machines are small in size, highly accurate, and simple in operation for high production honing of small parts.

Design features include air-impulse hone expansion with automatic rapid expansion, feed and collapse; automatic bore-to-bore sizing; magazine loading and automatic ejection. Automatic shut-down is also provided when honing stones become worn. Optionally, parts may also be automatically pre-gauged, honed, post-gauged, sorted and ejected.

Powered by an all mechanical system with a Vee-belt spindle drive, these machines require very little maintenance. Rigidity and accuracy are assured by suspending the reciprocating head between 2 columns.

For complete information on these machines and their application to high-production small-part honing, write BarnesdriL engineers.

specifications	Model No. 10A1	Model No. 15A2
Capacity (inside diameter)	3/8" to 1"	1/2" to 2"
Spindle Travel, maximum	2 1/2"	6"
Swing	10"	15"
Lift Out Stroke	6"	8"
Rotation and Reciprocating Motor	3/4 H.P.	2 H.P.
Overall Height	72"	88"
Floor Space	32" x 45"	42" x 63"
Net Weight	1150 lbs.	1650 lbs.
Gross Weight (crated, domestic shipment)	1450 lbs.	1950 lbs.
Gross Weight (boxed, export shipment)	1750 lbs.	2250 lbs.
Cubic Space, export shipment	159,600 cu. in.	162,480 cu. in.

50th year

BARNES DRILL CO.

886 CHESTNUT STREET • ROCKFORD, ILLINOIS
DETROIT OFFICE: 3419 South Telegraph Road

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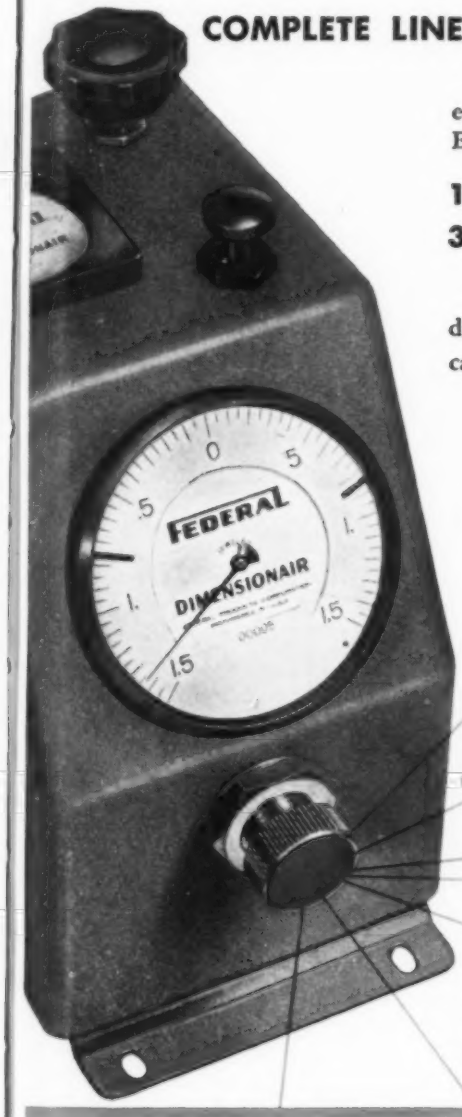
GET MORE OUT OF AIR GAGING WITH THE DIMENSIONAIR

COMPLETE LINE OF ATTACHMENTS FOR EVERY MEASURING NEED



It's so easy to greatly increase the scope of Dimensionair usefulness — and do it economically by using any of the "already designed and built" Attachments. Each of these Attachments answers three basic requirements.

1 Easily attached. **2** Wide range of adjustment.

3 Performance in keeping with quality of the Dimensionair

Let us show you how these Attachments will give you more for your air gaging dollar. Write for Catalog 56D or ask our nearest representative to discuss applications in terms of your own needs.

FEDERAL PRODUCTS CORPORATION
7449 Eddy Street • Providence 1, R. I.

AIRPROBE

Small and easily attached to many types of stock model gages. The ideal Attachment where mechanical contact is desired. Its long range per magnification and availability in .003, .006, .015, and .030 ranges adapt it for practically any type of air gaging, thereby bringing the benefits of air gaging to more unusual types of measurement.

Adjustable AIR SNAPS

Made in five sizes, 0" to 6", each having a wide range of adjustment. Anvils, precision lapped, remain flat and parallel throughout entire range of adjustment. Does not disturb the regular Dimensionair calibration: (.003" range at 2500:1 magnification.) Self-zeroing so that only a single master is required.

Adjustable AIR BORE GAGES

Only four gages cover all measurements from ½" to 8". Concentricity of centralizing contacts with the measuring contacts is so precise gage can be set with gage blocks or micrometer. Centralization remains accurate even though gage is cocked laterally, and is maintained throughout the capacity of the gage.

AIR RINGS

Regularly furnished with two or three jets. Can also be furnished with one, four, or six jets. Jets are larger and recessed farther below surface than in competitive makes. This helps eliminate clogging and reduces wear. Inside diameters from .250" up to and including 3.010". Smaller and larger sizes on application.

AIR PLUGS

Furnished in various types . . . Through Hole, Counterbore, and Blind . . . and having one, two, three, four, or six jets as required. Available from .125" diameter, up. Smaller sizes available. The jet faces are set lower in plug and provide greater protection against damage: air jets are larger and less easily clogged. Available from stock in many sizes.

ARNOLDAIR

Links the Federal Dimensionair to your Arnold Grinding Gage to provide closer operator control than is possible using a Dial Indicator alone. The Arnoldair response smooths out surface irregularities, allowing the operator to consistently grind pieces within .0001" of nominal. Easily attached to any Arnold Gage. Catalog 55A.

SPECIAL ATTACHMENTS AND FIXTURES

When the nature of the work or other conditions necessitate Special Attachments, Federal Engineers with their specialized gaging experience can provide the right design. Whether it's a specially designed Attachment or a modification of a regular design you can be sure it will be the best gaging Attachment for your work.

Ask **FEDERAL** *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging

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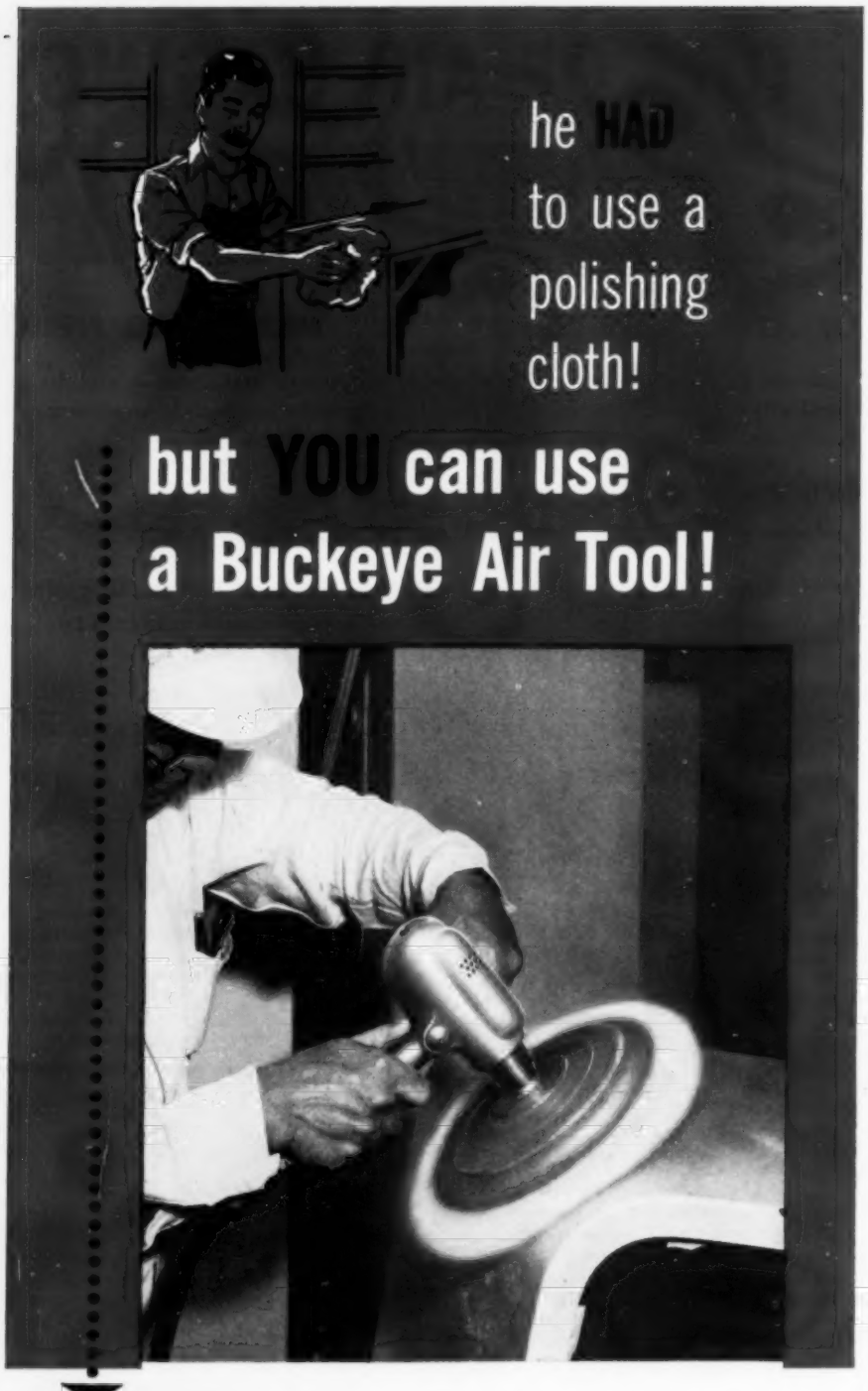

Why AIR Tools?

Because air is everywhere, just waiting to be put to work . . . because continuous operation can't possibly harm an air tool . . . and because, if you're using Buckeye air tools, you can almost forget about tool maintenance.

The old line craftsman, rubbing away diligently with his polishing cloth, took a great deal of pride—and a great deal of time—in his work. The modern craftsman, guiding a compact, lightweight Buckeye polisher or buffer, takes just as much pride in his work, and accomplishes far more in much less time. Mass production and pride of craftsmanship still go hand in hand, with modern Buckeye air tools.

In Air Tools, Your Best Buy Is Buckeye

Buckeye Tools
CORPORATION
DIVISION 45 • DAYTON 1, OHIO

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Industry Observer . . .

the industry, and the sooner, the better.

• *A minor revolution* in the sanding disc business could be in the making if a new product by Skil Corporation goes over well with disc users. Called "Perma-Grit T-C" abrasives, the new product is made by brazing tungsten carbide grit on steel backing. Claimed operating life is much longer than conventional discs, especially for nonmetallic applications. The company isn't recommending it for metalworking application, although in one test on flash-removal from aluminum die castings for a camera manufacturer, the disc reportedly lasted for 5000 pieces, versus 100 pieces per common sanding disc.

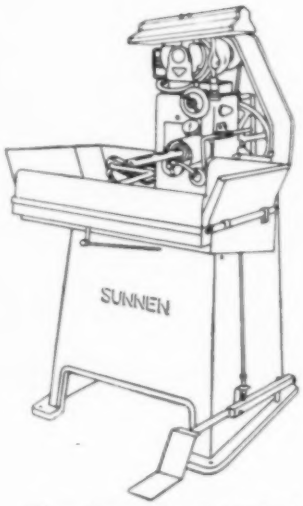
• *Grinding titanium* still isn't the easiest thing in the world, as L. C. Hays of Thompson Products points out in his article on the subject beginning on page 39. But a lot more is known about it, and with the pointers Mr. Hays offers, we hope the article will be helpful to readers who've had trouble with the wheel-devouring material. The experimental results given in the article are most encouraging.

• *Art for Engineers?* That's the proposal for a curriculum addition to MIT's courses for budding engineers, according to the industrial bulletin of Arthur D. Little, Inc. Courses in fine art, on the practical side, will help the engineer develop his powers of observation and intuitive judgment. With the many complex technologies that must be blended in some of science's newest realms, it's a good thing to have a man who can see complex relationships. The art courses would supposedly increase abilities along this line.

• *Without naming the concerns involved,* we can assure you that

(continued page 22)

HOW WOULD YOU PROCESS THIS TANDEM BORE JOB?



Diameter range of standard honing tools: ⅛" to 2⅝".

The piece requires a .0002" hole tolerance plus perfect alignment, roundness and straightness of both holes.

The best process for this tough job was Sunnen Honing. The Sunnen Honing tool hones both holes simultaneously . . . the workpiece is self-aligning on the tool. The one honing operation guarantees alignment, identical size and controlled surface finish in both holes.

Sunnen Honing eliminates the problems you have in machining tandem bores by other methods: clamping distortion; jump and chatter of long quills or boring bars; turntable alignment error; inconsistent finish produced by dull tools.

Sunnen Honing easily holds tolerances to .0001" . . . requires no fixtures and assures low cost per part. Average honing machine installation with tooling is around $1,000.

send for five informative

honing booklets

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SUNNEN® PRODUCTS COMPANY

HONING

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Canadian Factory: Chatham, Ontario

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A wheel for every job . . .

For every surface grinding job . . . whether tough as copper or fragile as glass . . . there's a Blanchard wheel that's *best*.

Blanchard grinding wheels, for use on Blanchard Surface Grinders, are made in cylinder, segment and sectored types. By selecting from a variety of vitrified, resinoid and silicate bonds and a number of different abrasives, Blanchard is able to make exactly the right wheel for every surface grinding job.

Precision duplication in the manufacture of every Blanchard grinding wheel assures you of identical results on all materials—regardless of finish or stock removal required.

THE BLANCHARD MACHINE COMPANY

64 STATE ST., CAMBRIDGE 39, MASS., U. S. A.

PUT IT ON THE **BLANCHARD**

THE BLANCHARD MACHINE COMPANY 64 State St., Cambridge 39, Mass.

Gentlemen: Please send me free copies of "Blanchard Abrasive Wheels and Segments" and "The Art of Blanchard Surface Grinding" (3rd edition)

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FIRM_____ CITY_____ ZONE____ STATE_____

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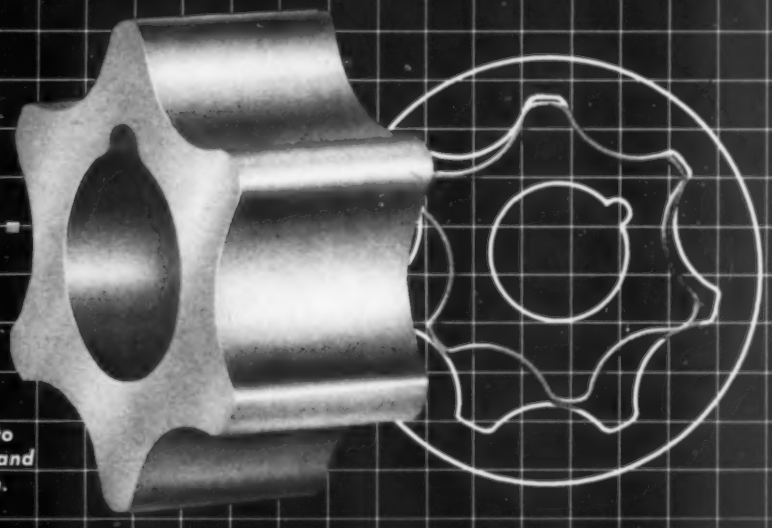
hoglund contour dressing...



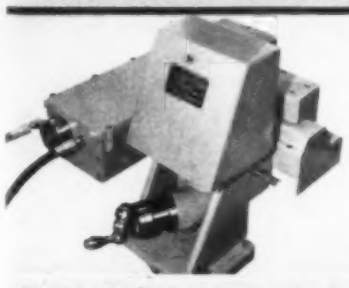
Six faces ground to .0002" tolerance and 9 microinch finish.

Closer tolerances in pump assembly increase rotor life and efficiency, improve slippage characteristics.

boosts impeller grinding rates — improves pump performance

13 stacked impellers are automatically indexed and the form ground in 6 separate positions.

After each impeller stack is ground, wheel is dressed at uniform peripheral speed with diamond normal to surface.



Hoglund Model 38A Dresser features computed master contour template, 10 to 1 inclined plane cam reduction, diamond cooling during dressing.

This impeller is typical of the countless form grinding applications where the accuracy initiated by Hoglund Contour Dressers enables both product and production improvement.

A Hoglund Model 38A Dresser, installed on a 12x40 surface grinder helped boost production 40%, improved tolerances, and lowered surface finish from 20 to 9 microinches. Combined high accuracy and high production are assured because: a) all Hoglund templates and ratio cams are individually computed to the job; b) only with the simplicity and ingenuity of inclined planes can you sustain accuracy and automaticity.

Over 120 different types of Hoglund Contour Wheel Dressers are now in service — enabling "tenth tolerance" contouring of intricate forms heretofore impossible to grind. They're adaptable to all types of grinders.

If you are grinding simple or intricate forms, you will want the whole Hoglund story in Hoglund's new technical brochure. Let Hoglund engineers recommend a suitable solution to your problem.

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Send for brochure on solutions to tough profiling problems.

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HOW USERS OF THE *Lusol* LINE

TEST COOLANT DILUTIONS

RIGHT AT THE MACHINE

IN 60 SECONDS

If your coolant dilution is too lean, you run the risk of rust; if it is too rich, you get stickiness and, what is more, you are wasting coolant and throwing money down the drain. Without checking, it is easy to throw your balance off as much as 50%. A regular laboratory analysis takes a good deal of time, but with this "concentration kit", users of the Lusol Line of coolants get the answers in 60 seconds. That's why users of Lusol products have no trouble in maintaining correct dilutions, and one good reason why they always get better results, greater machining accuracy, longer tool life, longer production runs. Investigate this unique and important control feature. A demonstration is yours for the asking.

Are you guessing?

- What coolant "mix" do you require? 20 to 1, 50 to 1, 100 to 1?
- Are you maintaining this dilution?
- This kit gives the answer to users of the Lusol Line in just 60 seconds.
- Let us demonstrate in your plant.

Send today for 16 page descriptive booklet

THE *Lusol* LINE

BETTER PRODUCTS FOR BETTER METALWORKING

F. E. ANDERSON OIL COMPANY, INC.

BOX 218 PORTLAND, CONNECTICUT

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Industry Observer . . .

the day of the completely automatic factory isn't too far ahead. The present state of development of automated equipment, with fully automatic quality control devices coupled with the growing field of automatic assembly, makes the whole thing a much more practical concept. It's nearer than you might think.

• *Operations Research*—the technique of applying mathematical analysis to operating problems in business and industry—is moving in to the complex realm of advertising with its computors and scientists. We wonder if they're really serious when they think they can analyze our wives' buying motivations. It looks beyond mathematics to us.

• *With this issue* we welcome to our staff a new field editor, Darrell Ward. Coming to us with a fine technical and writing background, Darrell will be calling on many of you as he extends the coverage of GRINDING AND FINISHING to include even more industry operations and on-the-spot stories.

"That drawing will explain everything completely . . . These drawings will explain that drawing."

Talk of the toolrooms!

New **SIMONDS**

SA *Borolon*®

TRADE MARK

GRINDING WHEELS

Faster, cooler grinding with heavier cuts

Exceptional for tool and cutter sharpening and horizontal surface grinding! Performance convincingly proved on tool-room grinders throughout industry. Unique single crystal formation of the abrasive cutting particles provides more stress-free cutting edges and permits cooler grinding, deeper penetration and better finish. Use SA Borolon wheels on *your* grinders. Get bulletin ESA 272 for details.

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SIMONDS ABRASIVE CO.

SIMONDS ABRASIVE COMPANY

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DIVISION OF SIMONDS SAW AND STEEL CO.

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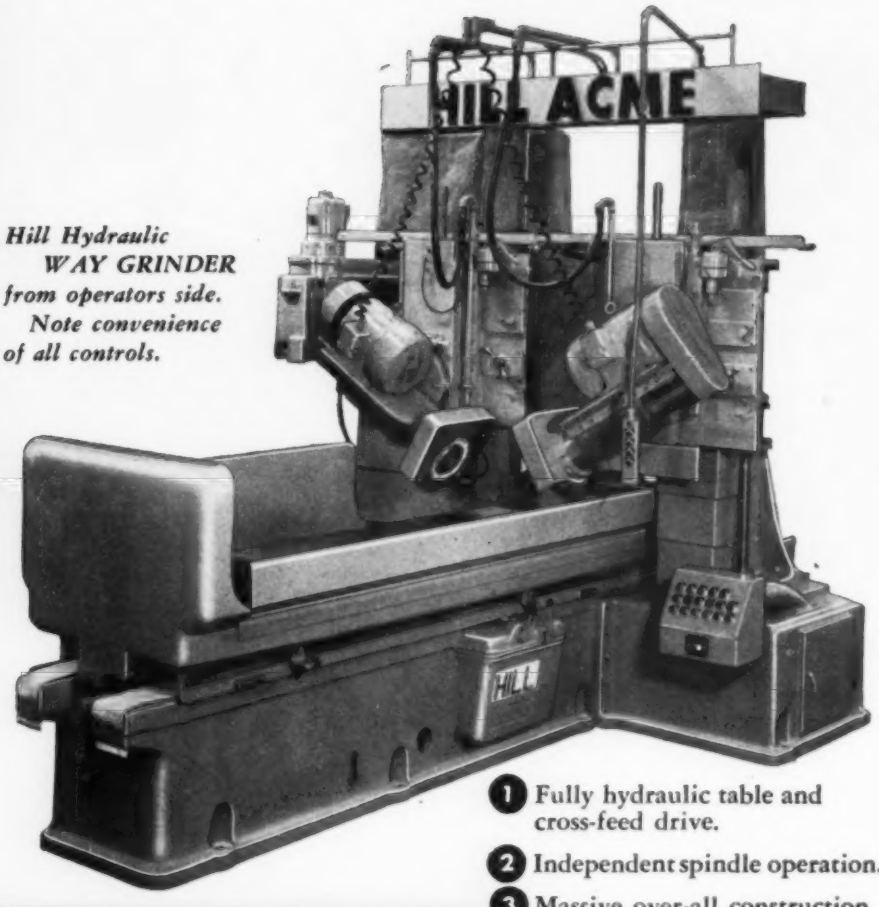
Q uick supply

HILL double housing WAY GRINDER for accurate grinding of V's, Flats and Angles

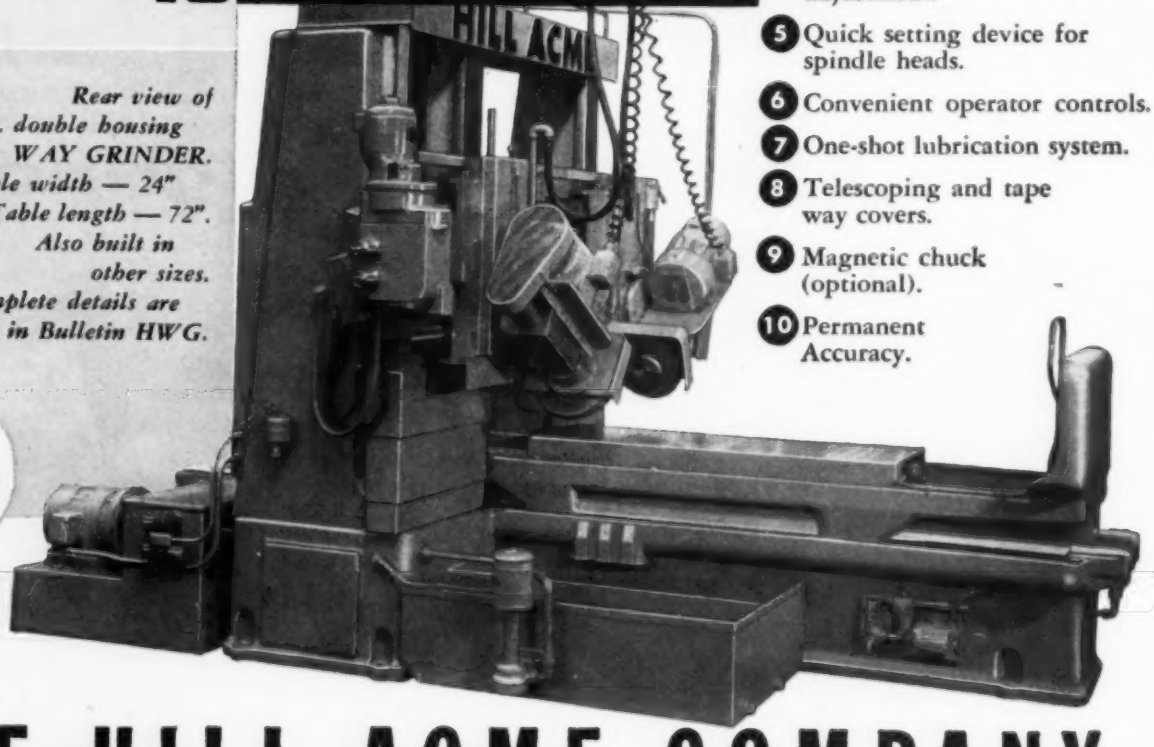
Substantial Savings (up to 50%) over previous methods.



Hill Hydraulic WAY GRINDER from operators side. Note convenience of all controls.

10 points worth considering

1. Fully hydraulic table and cross-feed drive.
2. Independent spindle operation.
3. Massive over-all construction.
4. Rapid traverse and fine feed adjustment.
5. Quick setting device for spindle heads.
6. Convenient operator controls.
7. One-shot lubrication system.
8. Telescoping and tape way covers.
9. Magnetic chuck (optional).
10. Permanent Accuracy.



Rear view of HILL double housing WAY GRINDER. Table width — 24" Table length — 72". Also built in other sizes. Complete details are given in Bulletin HWG.

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Grinding and Finishing

Editor's Page

The Know-Why of Automation

Probably nowhere in American technology is our vaunted "know-how" more apparent than in some of the latest achievements in automation.

But as fine as that know-how is, have we acquired a commensurate amount of "know-why" to go with it? Do we fully appreciate the implications of automation, especially in terms of its effects on industrial workers?

Having seen some of the latest innovations in the field of automatic handling and control in Ford's new Sterling plant, which you'll find described in a feature article in this issue, we'd like to comment on some of the implications of the current breed of automation.

It's encouraging for us to see that the very latest automation techniques have gone a long way toward freeing the worker from a role of slavery to the mechanical pace of a machine. We've gotten accustomed in past years to seeing human operators feeding parts to automatic-cycling machines, with no relief from the resulting monotony. In many cases, the machine would be equipped with the finest in automatic size control devices and cycle controls which enable a relatively unskilled operator to turn out good parts. But still, he'd have to move parts into and out of the machine with dulling regularity. Was this destined to continue forever? Would the operator forever be regulated by the machine pace, however "normal" a pace it might be?

The machine designers are firmly answering, "No!" The operator needn't be paced by the machines, say their new designs, which incorporate automatic handling equipment and automatically regulated parts banking.

It takes an extremely sophisticated mechanism to do the job human operators have been doing in loading and unloading parts. That's why such mechanisms have been slow in coming.

The stem pinion grinders at Ford represent the crossing of a tough hurdle—the automation of a delicate operation on a part that's extremely hard to handle. We think the operation is an industrial milestone.

The operator can view a machine like *that* in an altogether different frame of mind. Almost as a fellow worker, rather than an indifferent taskmaster. His skill at diagnosing troubles in the machine and correcting them can be applied without the nagging need to keep feeding parts to the monster. Its complicated mechanisms draw the best in analytical ability and skills from an operator. In this measure it restores an element of skill to a job from which it was taken just a few years ago by automatic sizing.

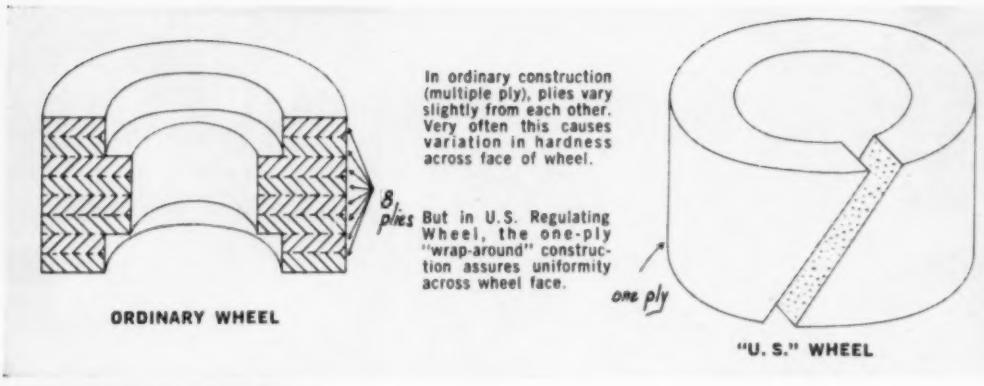
These are surely worthy goals of automation. We hope American industry will increasingly see the vital importance of "know-why" as well as know-how.

Jack Kenyon
Managing Editor

VULCANITE REGULATING WHEEL

3 Molding Methods make "U.S." Wheels the pace-setters

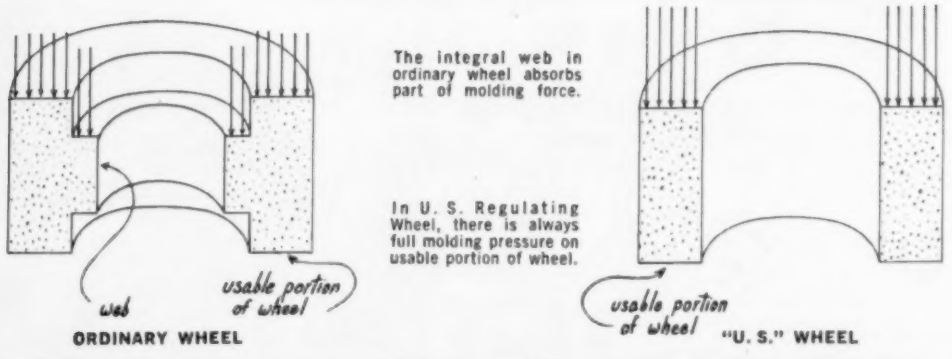
Unmatched Uniformity



In ordinary construction (multiple ply), plies vary slightly from each other. Very often this causes variation in hardness across face of wheel.

But in U.S. Regulating Wheel, the one-ply "wrap-around" construction assures uniformity across wheel face.

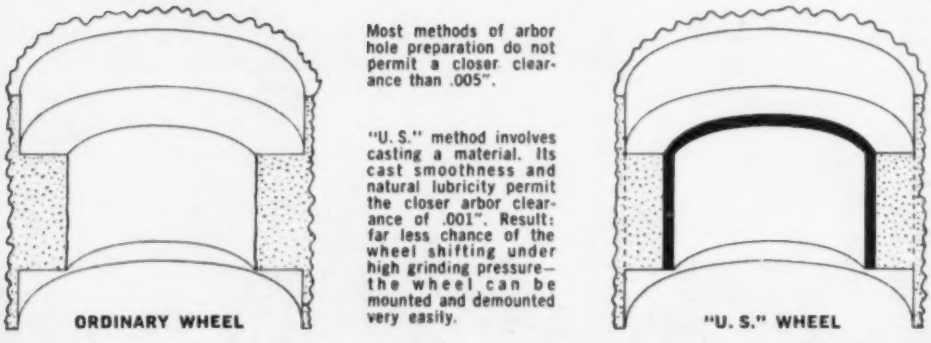
Full Molding Pressure



The integral web in ordinary wheel absorbs part of molding force.

In U. S. Regulating Wheel, there is always full molding pressure on usable portion of wheel.

Arbor Clearance of .001"



Most methods of arbor hole preparation do not permit a closer clearance than .005".

"U. S." method involves casting a material. Its cast smoothness and natural lubricity permit the closer arbor clearance of .001". Result: far less chance of the wheel shifting under high grinding pressure—the wheel can be mounted and demounted very easily.

Years of careful study of customers' needs resulted in creation of this U.S. Vulcanite Regulating Wheel. It has high resistance to wear, and precisely the right degree of traction and cushion. Less infeed is required, enabling the operator to hold size better. *Yet, U. S. Vulcanite Regulating Wheels cost no more than ordinary wheels.*

Write to Grinding Wheel Sales Department, United States Rubber, 4300 New Haven Avenue, Ft. Wayne 4, Indiana.

Mechanical Goods Division

United States Rubber

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Grinding and Finishing
SEPTEMBER 1957

AERIAL VIEW of Ford Motor Company's new Sterling Township, Mich., chassis parts plant. Plant contains 1,800,000 square feet of floor space, employs more than 6,500 persons.

Automated Grinding at Ford Sterling

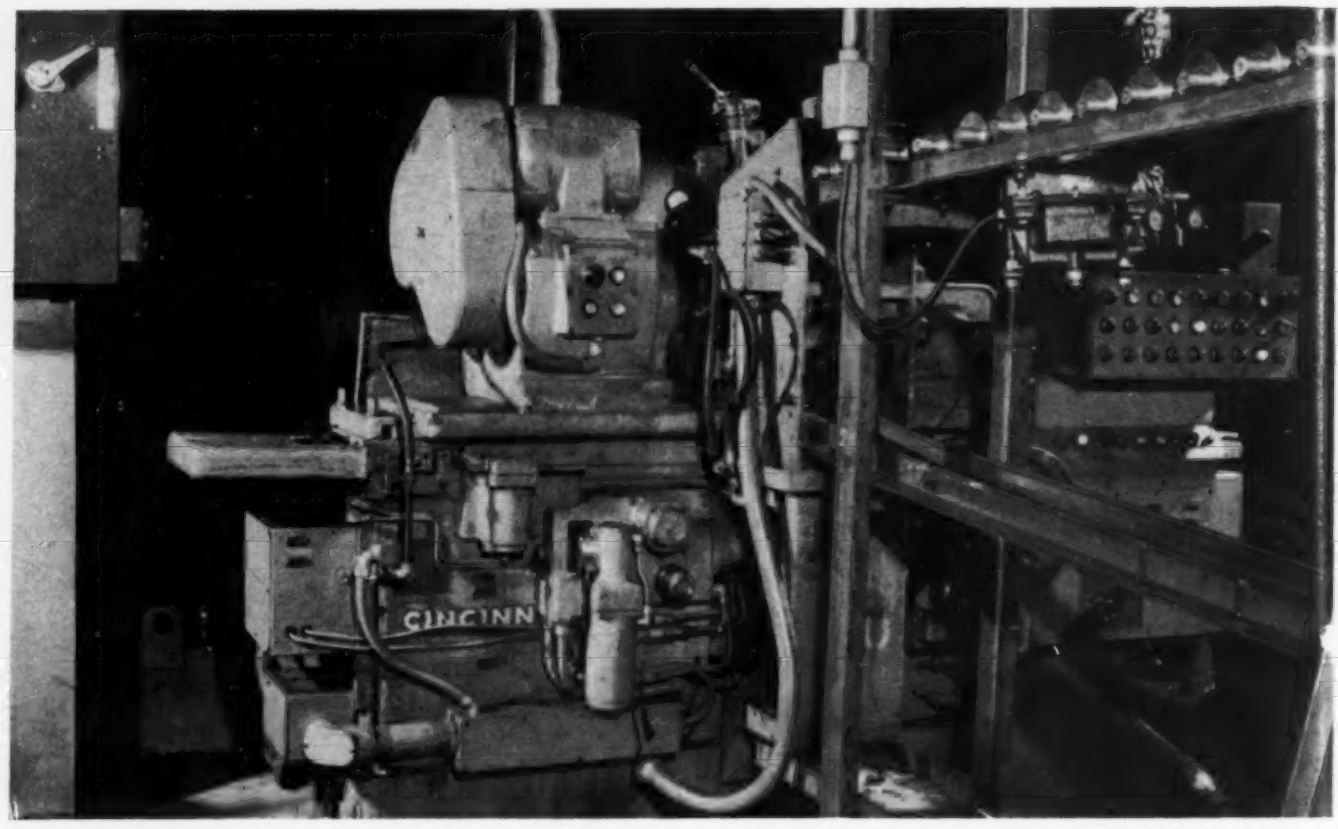
by **Jack Kenyon,** managing editor
as told by **Max Winter** and
Edward Moran, Ford Motor Co.

● Manufacturing operations at Ford Motor Company's new chassis parts plant in Sterling Township, Michigan, include some of the most highly automated grinding operations in the country, as evidenced by the stem pinion operation on our front cover and others to be described in this article. The Sterling plant produces rear axle assemblies, drive shaft and ball-joint front suspensions for Ford, Mercury and Edsel passenger cars, as well as similar assemblies for Ford trucks.

Ford decided to build the new plant about three years ago when a new line of chassis parts designs was proposed. In the resulting new processes in the Sterling plant, material handling and other automation devices have made the facility one of which the corporation is justly proud. The plant was completed in September, 1956. It contains a total of 2000 machine tools, 1200 of which were purchased new for the facility, the balance brought from the company's former Mound Road plant which produced similar parts.

As at other new Ford plants, every spot where automation has been used was subjected to thorough analysis. To be worthwhile, the installation had to produce results in terms of improved quality, maximum efficiency, better working conditions or greater safety. Ford has realized the automation of processes in the Sterling plant for which the automotive industry has been shooting for quite a while. Transfer processes are very much in evidence, as are automatic assembly machines.

Maintenance demands of an operation as large as Ford Sterling are of great importance, especially when so much of it is highly automated. In the new plant, requests for maintenance service are sent out by a central telautograph system to sub-stations throughout the plant, quickly bringing maintenance crews to the scene of trouble areas.



FULLY AUTOMATED angular head grinder for the green grind of two diameters and thrust face of stem pinion as it comes out of automatic Fay lathe operation. Machine cycles continuously without operator attention. Parts banking chute, right, feeds pinions to rotary indexing load-unload carrier. Before grind starts, feedback gage-controlled actuator, immediately right of machine nameplate, positions machine table axially with respect to grinding wheel, permitting accurate stock removal from shoulder. Indicator panel lights, right, tell portion of cycle machine is performing.

Automated Grinding At Ford Sterling . . .

Complete Automation of Stem Pinion Grinding

One operation sheet in the processing sequence for the stem pinion in the Sterling plant is labelled "Green Grind, Spline and Bearing Diameter and Thrust Face." Thus concealed in prosaic wording is one of the most fully automated center-type grinding operations in this country, the subject for our front cover photograph this month.

The operation takes place at the end of each of six Fay automatic lathe lines, where the SAE 4028 steel pinions begin to take form from a rough forged condition. After rough and finish turning in the Fay lines, the pinions are placed in a gravity type parts bank feeding the green grind operation.

The operation is done on a standard two wheel 10 x 18 Cincinnati angular wheelhead grinder equipped for "on-demand" automated operation. Barring unscheduled stoppages, it can operate continuously, turning out good parts, for the life of the perishable items on the machine without operator attention. The grinder is equipped with automatic loading and unloading, feedback control of axial positioning of the table and of diameter sizing, automatic wheel balancing and dressing, all of these performed without operator attention. Every element of its automatic cycle is electrically interlocked with previous steps so that the part and the machine are protected from improper cycling.

The gravity-fed parts bank preceding the grinding operation has been made large enough to supply parts to the grinder for a long period in the event of downtime on the Fay operations. In order for the grinder to cycle, there must be a part in the bank waiting to be ground, and an empty place on the grinder's discharge conveyor in which to put it after it's ground. The parts are positioned between the machine centers in a ready position by a rotary spider type loading device which remains stationary during the actual grind. The first thing that takes place is the advance of the tailstock, which carries the part into the headstock chuck. The headstock chuck is unique in that it is designed for automatically gripping the part on its pilot diameter as

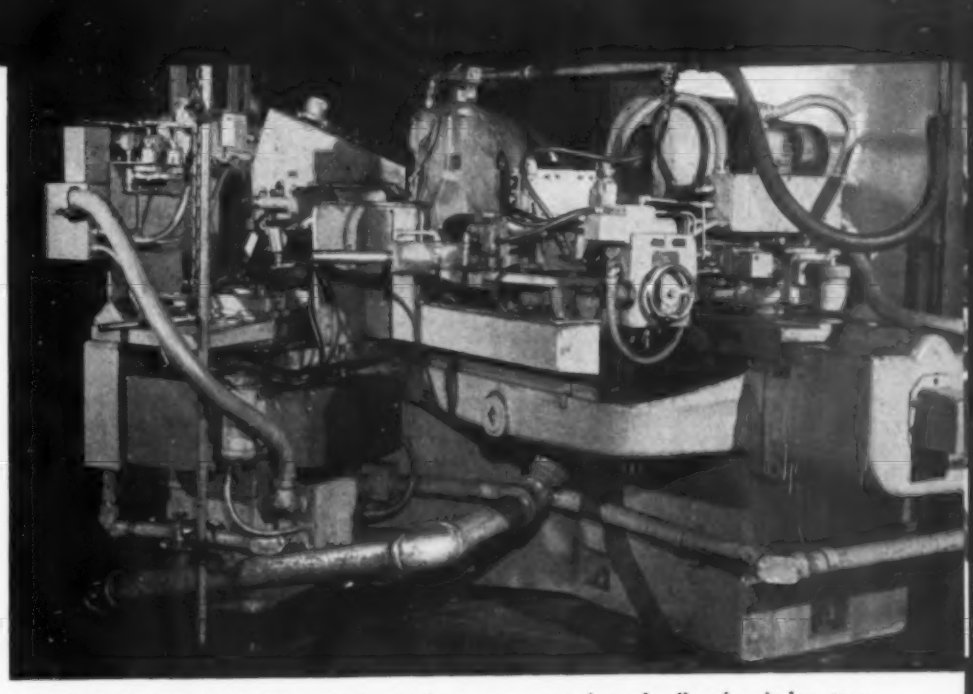
rotation starts, disengaging at the completion of the grind by momentary reversing of headstock rotation.

Since this operation involves grinding against a shoulder, and because it is impossible to hold the center depth on the part to sufficient accuracy in the preceding operations, the grinder is equipped with an automatic gage-controlled axial positioning device to locate the part very accurately with respect to the grinding wheel before the operation starts. This is done by means of a feedback controlled gage which contacts the thrust face to be ground, signalling the table traverse control until the correct position for the start of the grind has been established. Then the table is automatically clamped until completion of the grind. This axial positioning insures that the face is always cleaned up, removing the specified .005-inch of stock.

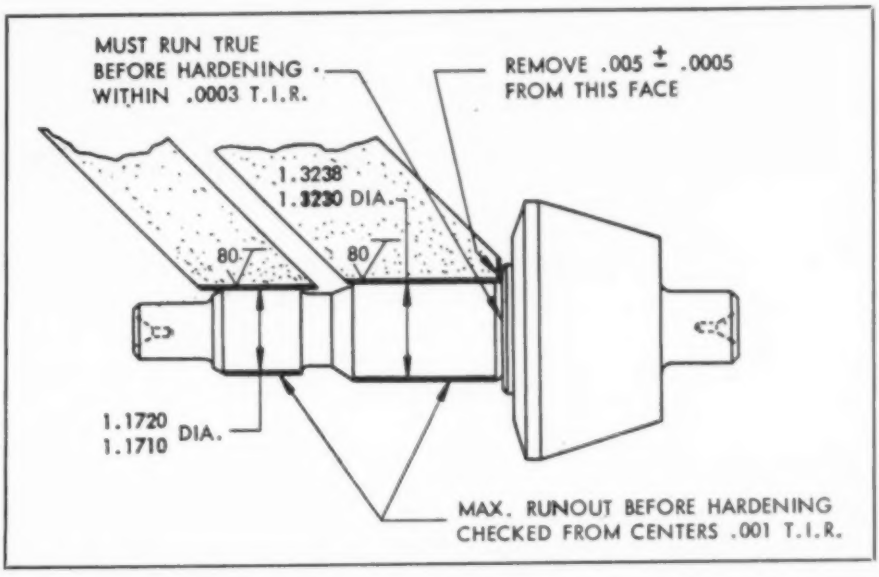
Following table positioning, the air-operated size control gage caliper swings into position and the grinding cycle of fast approach, fast feed, slow feed, and retraction on reaching finish size is carried out. Cycle time for this phase of the operation is maintained constant by a device working in conjunction with the size control gaging unit. Its basic function is to reduce to an absolute minimum the time spent "cutting air" before actual grinding proceeds.

When final size is reached and the grinding head retracted, reverse rotation of the headstock frees the part and enables a stripper arm connected to the footstock to strip the part from the chuck prior to unloading. Retraction of the footstock completed, the part again rests on the load-unload spider, which takes it to the discharge chute. The machine table returns to "home position" after each grind cycle in preparation for axial positioning for the next part.

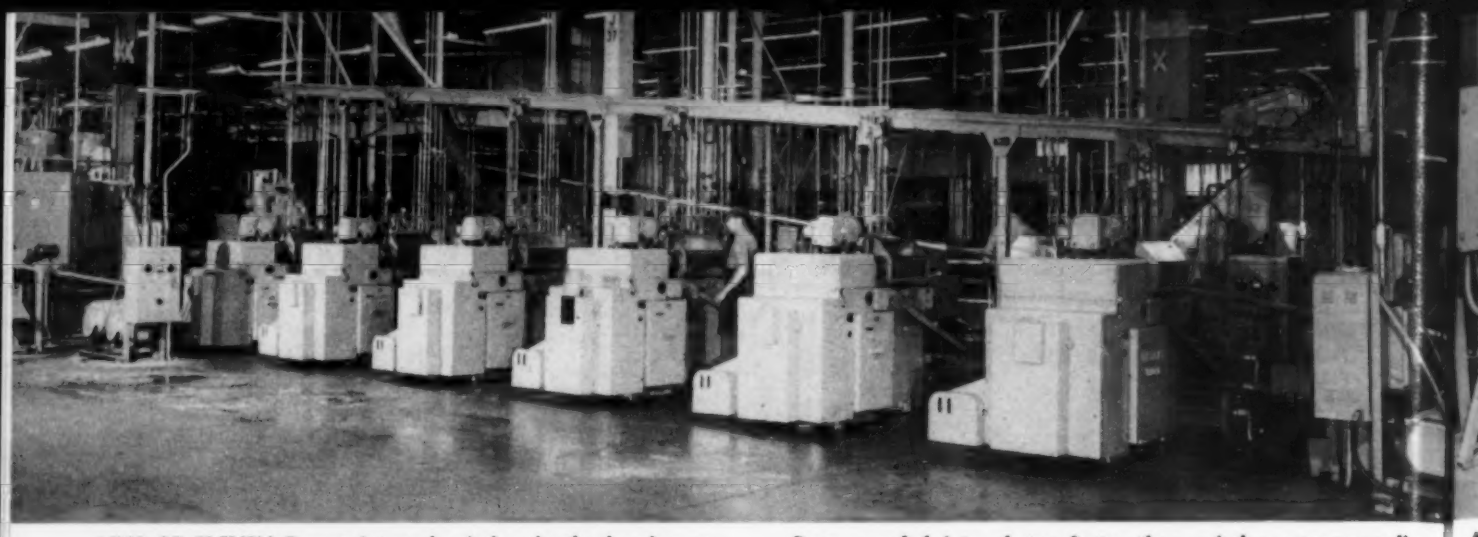
Stock removal for the grinding operation is .010-inch on the spline and bearing diameters, and .005-inch on the thrust face. Wheel which grinds the spline diameter is 27 x 1½ x 12, with the specification A36-K6-V, while the other wheel is a 30 x 2½ x 12, A60-K6-V. Coolant is soluble, in a 24:1 concentration.



AUTOMATIC THREE-RATE infeed attachment on angular wheelhead grinder compensates for wheel dressing and wear to maintain proper size control of finished parts in response to signals from feedback gage.



ROTARY SPIDER parts carrier brings pinion into position for pickup by machine centers. Note limit switch which signals presence of part. On completion of grind, rotary carrier takes part to gravity chute, picks up new part from incoming parts bank.



LINE OF ELEVEN Bryant internal grinders in the bearing cup sequence are served by overhead parts chuting. Individual machines cycle at own optimum rate, independent of others. Parts are fed into chutes faster than grinders can normally use them, to insure positive supply with no waiting by machines. Roving setup men change wheels, turn diamond dressers.

AUTOMATED GRINDING AT FORD STERLING . . .

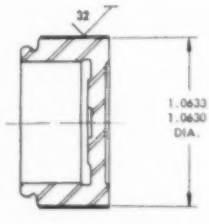
Integrated Grinding Line Produces Universal Bearing Cups

Complete automation of the grinding line producing universal joint bearing cups is accomplished by linking seventeen grinders with fully automated parts handling devices and storage banks for parts in process. The parts handling system developed for the Sterling installation carries the small cups through three basic processes—OD, ID, and face grinding—at an overall gross rate of 3000 per hour. Machines connected by the system are three Cincinnati No. 2 thrufeed centerless grinders, eleven Bryant 2209 internal grinders, and two 16A2 Blanchard grinders. Provision was made for independent feeding of parts to each of the Bryants, and a minimum storage of 10,000 parts between all sections of the system.

To feed all these machines efficiently and reliably, the line was divided into three sections, each section served by its own parts handling facilities. For the OD grind, three No. 2 Cincinnati centerless are arranged in series, to avoid multiple passes of the work through the same machine. The first machine handles the rough grind, the second a semi-finish pass, and the third brings the race to finish size, within limits of .0003-inch. Total stock removal on the three centerless operations is approximately .010-inch. Stock differences on the incoming parts are remarkably low because of the pre-

Grinding sequence on bearing cups . . .

Operation sketches at right show the processing steps in the fully integrated grinder line which produces universal joint bearing races from turned blanks. 1, part OD is ground in pass through three centerless grinders. 2, grind face and ID of cup, forming the roller race of the part with slightly crowned bore. 3, grind closed face of cup on specially fixtured Blanchard grinder. 4, grind opposite face.



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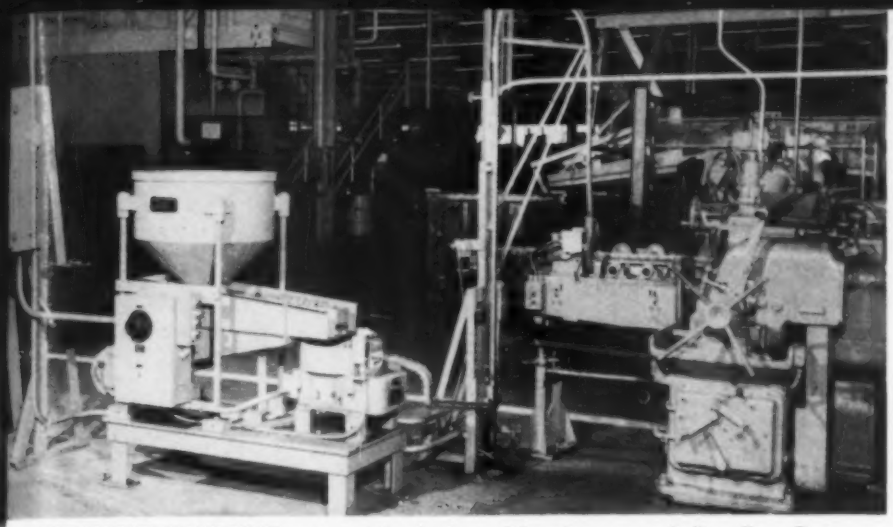
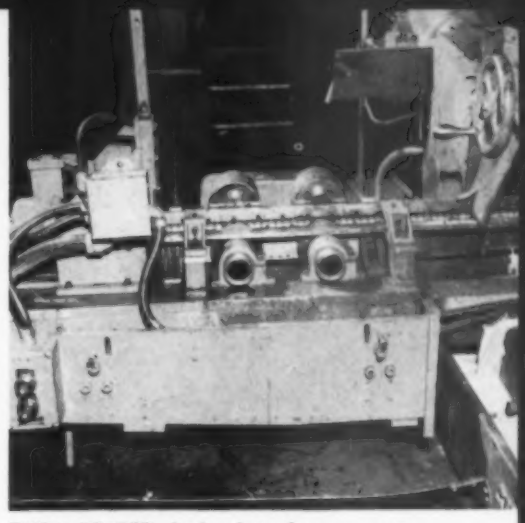
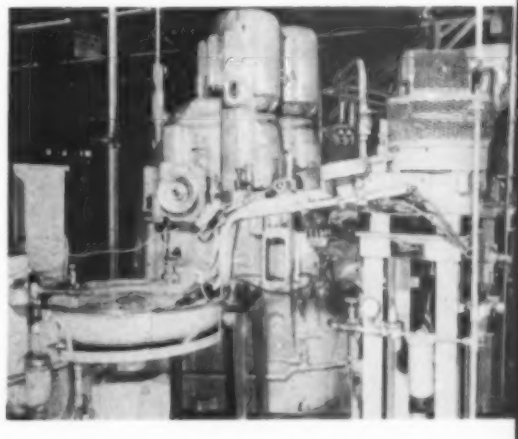


AUTOMATIC HANDLING setup at beginning of bearing cup grinding line. Parts are dumped in bulk into large hopper, left, which keeps cups at a specified level in vibratory hopper before they are fed into delivery chute to machine. Thrufeed device maintains parts flow up to 50 inches per minute to first of three centerless grinders.



THRU FEEDER device introduces cups to first of three centerless grinders.

FIXTURE TABLE of first Blanchard in bearing cup line. Parts are positioned cup side down onto magnetic fixture pins.



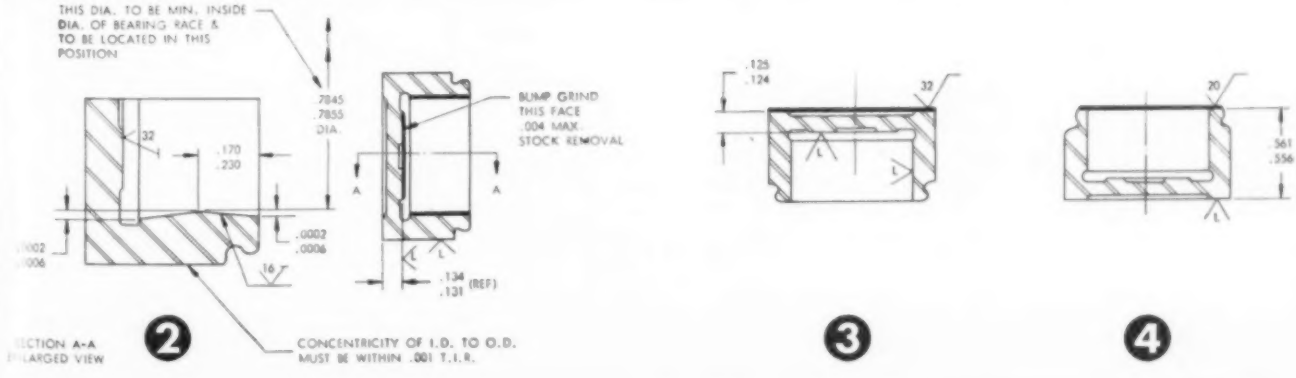
LOADING TABLE arrangement of second Blanchard. Parts stream tangentially onto rotary table, left, before pickup by magnetic chucking table of grinder.

vious processing steps Ford uses to form these parts. Instead of being produced entirely on automatics from bar stock, they are made by forming sheet metal blanks in a press operation, then turning only the necessary reliefs and chamfers on automatic chuckers. The parts are carburized to a case depth of .030-.040-inch and a hardness of Rc 59-64 in a rotary carburizing furnace.

The parts handling system for the automated grinding sequence, engineered by the KDI Corporation, introduces the bearing cups to the first thrufeed grinder at a rate of 50 inches per minute or better, maintaining accurate squareness of face to OD. The feeder in turn is served by an integrated hopper supply system. Parts are received in bulk by a four cubic foot storage tank with a capacity of 16,000 parts. They are then fed by a vibratory trough controlled by a load limit switch floating on the parts which maintains optimum level in the hopper. From the hopper, parts are fed with random orientation in a rolling position to a pneumatic elevator where they are forced through contoured chuting to the input chute of the Thru Feeder which supplies the centerless machines. The Thru Feeder is mounted on the grinder work rest support and moves with it when the wheel is dressed.

After the roughing pass, using an A80-K12-VH centerless wheel, the cups are conveyed to a storage bin for the semi-finish grinder, fed through and brought to the third grinder for the final pass. After the finish grind on the third Cincinnati, the parts are conveyed to the receiving bin for the second section

(next page, please)



of the line, the ID grind.

Internal Operation

Eleven Bryant internal grinders, Model 2209D, are arranged in two parallel rows and supplied by their own overhead parts handling and distribution system. From the bulk storage bin, via a vibratory trough to the vibratory feed hopper, the bearing cups are oriented with respect to the open face and fed through a gaging section of chuting to check for possible oversize parts. In this way the possibility of off-size parts jamming the system is eliminated.

Parts are placed into the dual overhead chutes servicing the two rows of Bryants at a constant rate in excess of grinder requirements. Any excess cups fed into the system above the machine requirements are re-circulated back into the initial storage bin at the head of the internal line. Individual escapements from the main overhead chutes feed each grinder independently, to provide for wheel changes and other machine servicing without interrupting the entire part flow.

The grinding operation on the Bryant internal machines not only finishes the ID of the part, which is a roller race, but with the same internal wheel it cleans up a face in the bottom of the cup against which the bearing rollers side. The parts come down the feed chute and are picked up by an arm which loads them to a precise axial position in the drawbar-operated diaphragm chuck.

Rather than being a straight internal diameter, the ID of the bearing cup calls for a slight crowning effect on the race, with limits of .002 to .006-inch crown. The grinding wheel must be dressed thus to a concave form. Concentricity of the ID to the OD is held within .001-inch total indicator reading, the size tolerance of the bore is held to .7845-.7855-inch. A 16 microinch finish is specified on the ID, while the finish on the inner face is 32 micro. Dressing of the end of the wheel is necessary as part of the cycle as well as the face. The wheel on this operation is a 3A-100M7-V22, operated at 35,000 rpm by the Bryant high frequency wheelhead.

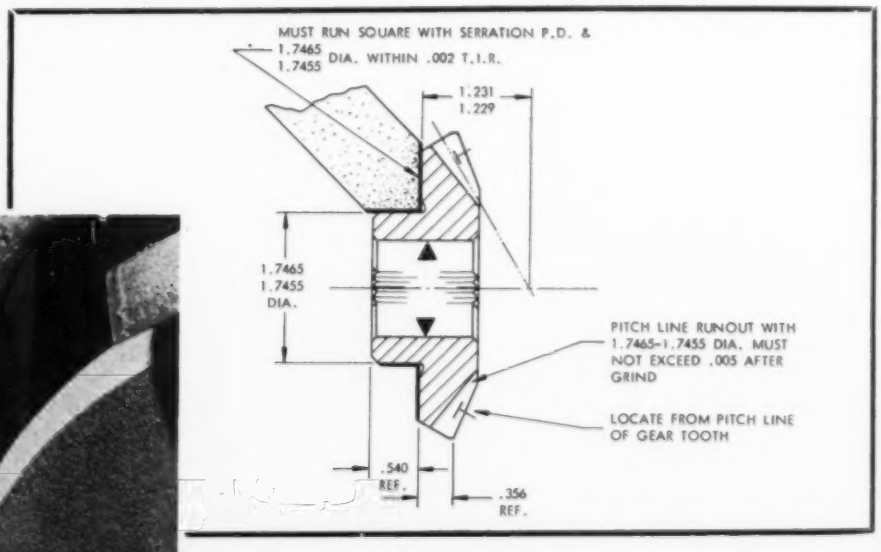
Face Grind Section

After ejection from the Bryants, the cups roll by gravity to a central return conveyor, which carries them to a storage bin serving the Blanchard grinders of the face grind section. A vibratory hopper feeds the parts oriented open face down to the first of two Model 16A2 two-spindle Blanchards. By means of a special feeding device, they are positioned onto vertical locating pins on the grinder table and held by magnetic clamping. The height and diameter of the fixture pins is carefully controlled to maintain accurate squareness of the face to the bore.

The first Blanchard removes approximately .012-inch stock from the back face of the part in a rough and finish operation. Parts are automatically ejected from the machine after their pass under the grinding heads to a hopper serving the second Blanchard.

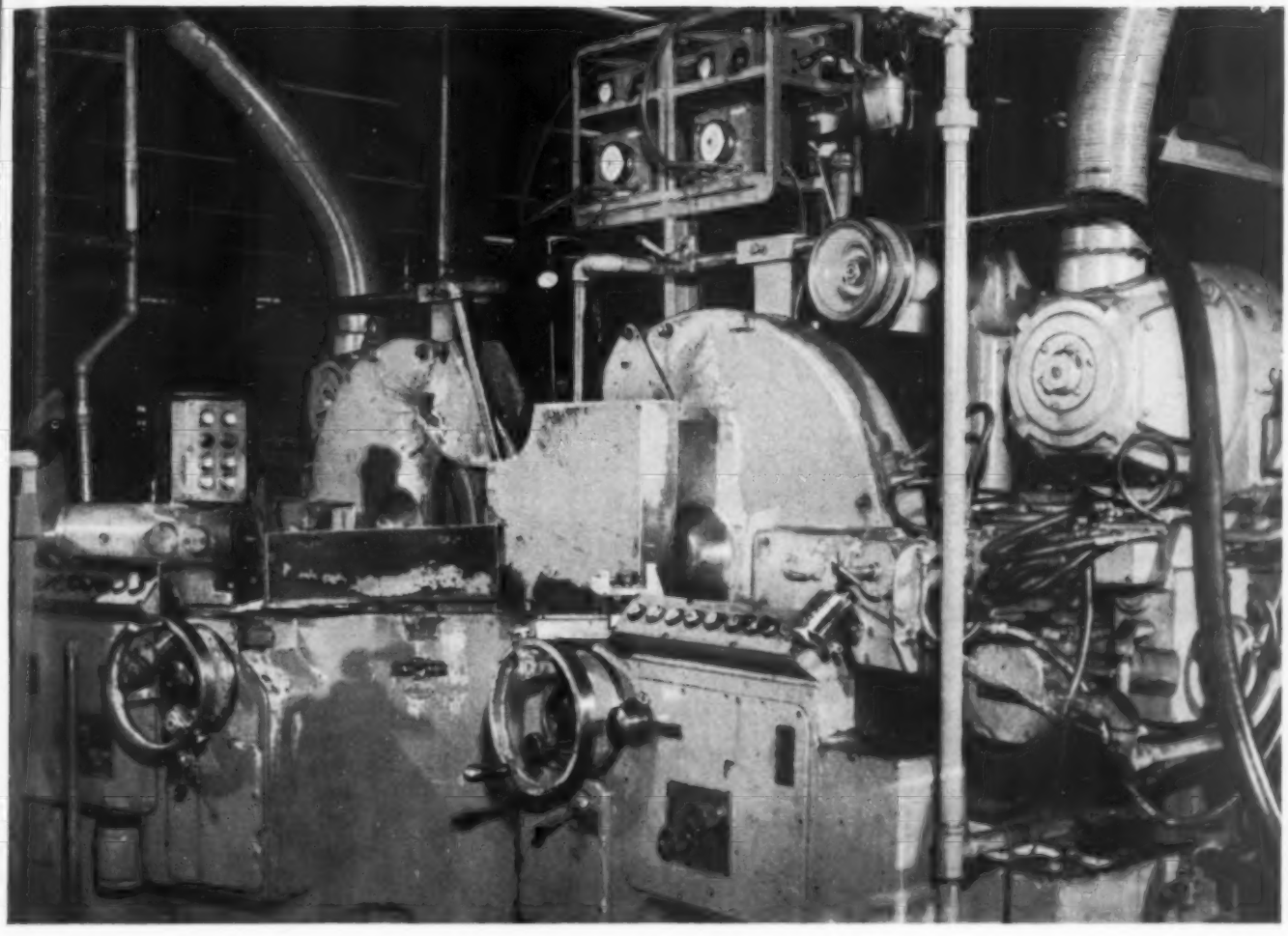
In the second face grind, the parts are fed open face upward to the table of the grinder for final sizing.

Parts are automatically ejected from the second Blanchard to a takeaway conveyor which takes them to a wash and dry unit. From the wash unit, finished races are discharged directly into a 10,000 part storage bin for transfer to assembly operations. • • •



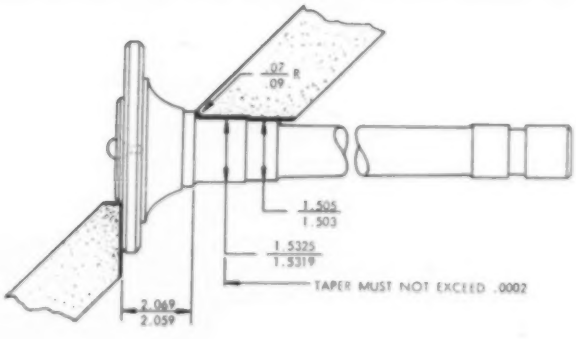
Chucking grinder operation on side gear . . .

TOOLING CLOSEUP, left, shows special diaphragm chuck which grips side gear for hub and face grinding operation on Cincinnati chucking type grinder. Operation is automated, with automatic loading and size control. Alignment pins on chuck insure that part is held for concentric grinding of hub with respect to pitch diameter of gear teeth. Locater pins engage gear teeth, while expanding collet grips splined hub ID. Stock removal in operation runs .010 on hub OD, .005 on shoulder.



Rear axle grinding . . .

SPECTACULAR MULTISURFACE OPERATION on rear axle uses twin opposed-wheel angular head grinder for heavy stock removal. Electric gage sizing controls machine infeed, final part size. Diameters ground in this operation must run concentric within .002-inch TIR. Shaft is SAE 1038 steel forging with hardness of Rc 40 minimum on ground diameters.



IN REAR AXLE operation, wheel at left grinds bearing and oil seal diameters with adjacent shoulder, while wheel at right grinds pilot diameter and broad face of flange. Grinding wheel for bearing and oil seal operation is a 36 x 2¼ x 20, 3A-80L6-V2. Flange face and pilot diameter are ground using a 36 x 1¾ x 20 wheel, A-461-L6-VA.

CHICAGO STEEL SERVICE'S new wet-process abrasive cutting machine, with capacity for very large plates up to 3 inches thick. Capacity itself is an important selling point, since few stainless users are equipped to machine pieces this size. Unit has two 40 hp heads mounted on crossrail at right angles for longitudinal and cross cuts. Though machine was designed for wet cutting, company installed its own 4000 gallon recirculating water tanks (against wall, right) to insure adequate flow. Leveling adjustment device for machine's longitudinal rails, an important factor in proper operation, are built into steel support piers. Piers were fabricated in Chicago Steel's shop.

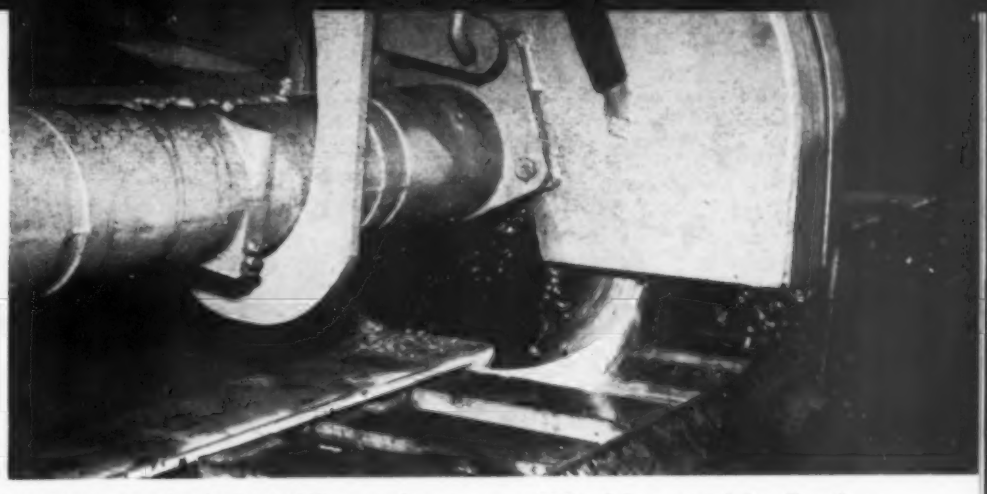
How a Chicago stainless distributor uses

Wet Abrasive Cutting

Selling more stainless steel was the motivation which called for installation of a large Ty-Sa-Man rail-mounted abrasive cutting machine in the plant of Chicago Steel Service Company, one of the country's largest stainless distributors. By offering its customers stainless plate of any analysis, custom-cut to close tolerances, the company keeps its customers from worrying how they're going to machine and finish huge flame-cut plates in limited shop facilities, or saves others the prohibitive expense of having a fussy analysis of bar stock rolled at the mill, just to get a small order filled. The operation is being carefully evaluated by Chicago Steel Service, and results to date are very promising.

SUPERIORITY OF ABRASIVE CUT (right) over flame cut (left) in this 1 ½ inch stainless plate shows why Chicago Steel Service went to abrasive cutting for better customer service. Abrasive cut was made in three passes. First is a light scoring or guide cut, about ⅜-inch deep. Light feather-edge burr resulting from abrasive cut can be flicked off with finger. Company is shooting for ultimate accuracy of plus or minus 1/32-inch.

CONTROL CONSOLE on operator's "pulpit" of Ty-Sa-Man machine travels with crossrail as longitudinal cuts are taken. Feed rates of machine are variable, driven by long feed screws or rack and pinion. Cutting spindle speed is fixed at 1600 rpm.



24-INCH CROSS-CUT WHEEL completes a cut. Wheel is rotated in direction analogous to "climb" milling. Wheels that are too hard will deflect under normal head pressure, cause wandering of pilot cut. Wheels with relief holes intended for self-dressing action and good for bar-stock cutoff, have generally proved unsatisfactory for stainless plate cutting.

RUBBER AND RESINOID bonded wheels are being evaluated in extensive test program by "Scotty" McNeil, superintendent of Chicago Steel Service's warehousing operation. Record of every stainless plate-cutting job is kept, with intention to standardize on one wheel specification for thick plates, another for thin ones. Marked variation in wheel performance has been noted thus far, working with machine's fixed spindle speed of 1600 rpm. This gives 10,000 sfpm peripheral speed with 24-inch wheel.

ABRASIVE CUTTING

DATE_____ OPERATOR # _____ PL. THICKNESS _____ FEET CUT _____

LOCATE STOCK MOUNT CLAMP TIME NET SIZE _____ # PCS. _____

TIME CUTTING _____ TIME TO REMOVE STOCK SCRAP & PARTS _____

SCORE CUT DEPTH _____ INDICATOR SPEED _____ TIME _____

2nd	"	"	
3rd	"	"	
4th	"	"	
5th	"	"	
6th	"	"	
7th	"	"	
8th	"	"	
9th	"	"	
10th	"	"	
11th	"	"	
12th	"	"	
13th	"	"	
14th	"	"	
15th	"	"	
16th	"	"	

WHEEL NAME _____ CODE _____ GRADE _____

SPEED _____ OD _____ THICKNESS _____ COST _____

WHEELS USED _____

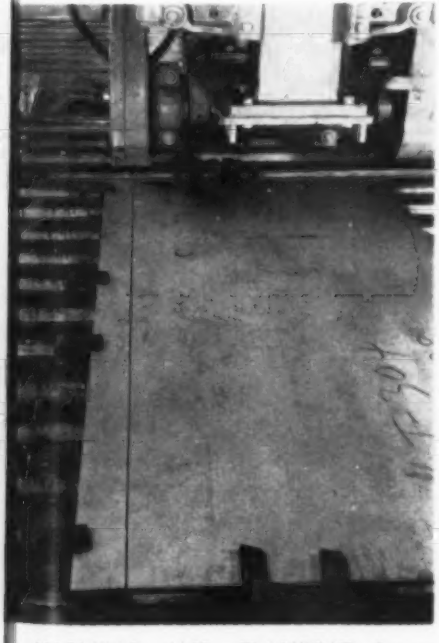
QUALITY OF CUT PIECES G __ B __ F __ DIMENSIONAL VARIATION _____

NORTH END PLUS ___ MINUS ___ SOUTH END PLUS ___ MINUS ___ CENTER _____

WHEEL BREAKAGE # _____ AT SPEED _____ KERF-DEPTH _____

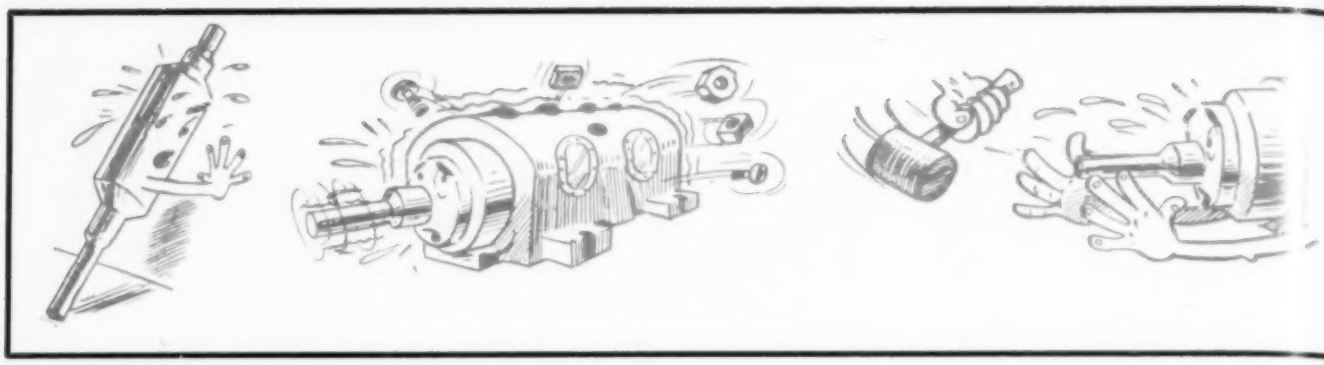
HOURS WORKED BY HELPER ON THIS JOB AND WHY _____

OTHER COMMENTS -



ALIGNING AND CLAMPING large plates on table has presented problems. Rough alignment is made by lining up plate with cuts in wooden 2 x 4's of clamping table. Company anticipates using hydraulic clamps to reduce setup time.

CONTROL OF SPLATTER has been one problem connected with wet cutting operation. Trick is to shield equipment adequately without restricting operator's view of cutting head. Here longitudinal head nears end of cutting stroke on half-inch plate, with crosshead raised. Accurate right-angle cuts with no setup changes are possible with twin-head arrangement.



1. HELP! I CAN'T STAND! —Never set spindle on end.

2. DON'T EVER operate a spindle with loose nuts.

3. NO! NOT THE HAMMER!—Don't ever hammer on end of spindle for any reason. Blows are transmitted to bearings, causing failure.

What's involved in proper

Care of Grinding Spindles

● It is said that the spindle is the "heart" of a grinding machine. Like the human heart, a spindle often is more taken for granted than properly maintained. It can develop numerous symptoms which call for serious attention. However, unlike the human heart, a spindle will not repair itself if you let it rest. It can only become worse with wear.

Since a grinding machine is a precision instrument, one might well be surprised to see the disregard often shown for the heart of that precision instrument. As in the practice of medicine, this mechanical heart requires expert care. The best medicine, of course, is preventive. The next best is a cure for an existing ailment.

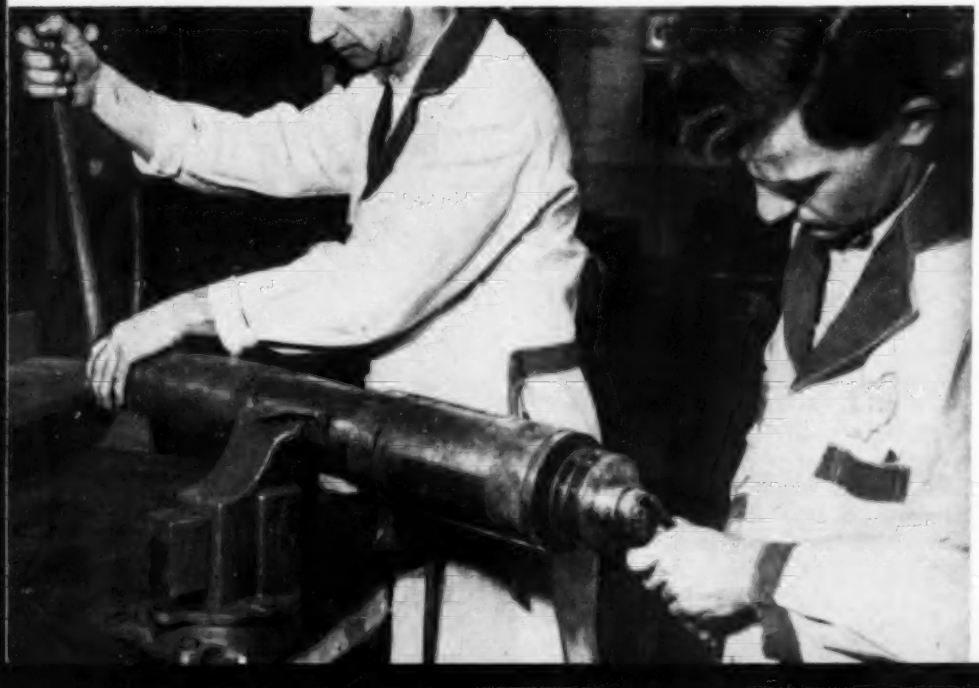
If a spindle is given the normal care it should have, its potential life might again be compared with the human heart. The bearings might just wear down after a long period of service—die of old age, so to speak.

Unfortunately, this is not the case with many spindles. Premature bearing failures often result from operating the spindle above the rated RPM. This is a sure way to heat the bearing, cause excessive wear, and possibly force out the packing grease to have the bearing run dry.

At the pulley end of a spindle, there is the common problem of premature bearing failure from operating the pulley belt too tight. If the setup man or machine operator is not thoroughly familiar with proper tensions on pulley belts, it would be a wise preventive measure to see that he is properly instructed, right away.

At the business end of the spindle, there may be even more chances for bearing failure if the operator attempts to "hog out" the work, taking too much cut in a single pass. This might indicate impatience, ignorance, or plain carelessness.

Misuse in operation of a spindle, however, is not the only source of problems. Accidents take a large toll. Mishandling, jamming a spindle into the work piece, having a quill break or freeze in a quill hole, and stripped wheel screw threads

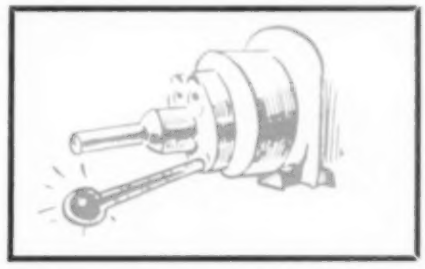


FIRST STEP in repair of precision grinding spindle at Bearings, Inc., is disassembly. Vise jaws are copper-jacketed to protect spindle. Repair men have to have the proper regard for shaft and housing tolerances, and treatment of spindle takes on similarity to medical examination of human patient.

4. DON'T EVER OPERATE with spindle out of line when grinding. That is, with centerline of spindle out of line with centerline of work.

5. OHHH—THOSE LACINGS!—Don't use laced belts. The vibration they cause makes it impossible to obtain the best finishes on the work, as well as actually causing bearing failures through pre-loading.

6. UGH! TOO TIGHT!—Bolts should be no tighter than amount required to prevent turning of spindle body in bracket.



7. NOT YET!—Don't tighten up quills when placed in hot spindle. Wait until spindle cools to same temperature as quill.

The grinding spindle, at the heart of the precision grinding operation, deserves the best of care. Here are some tips from Bearings, Incorporated, which will help you get the most from this vital component of your machine.

are relatively common accidental failures which lead to expensive repairs.

Still another cause of failure seems to be more or less widely ignored in some shops. This is the attention required for proper storage technique when a spindle is out of service for an extended period. A spindle should neither stand on end nor be left too long in a horizontal position without occasional rotation to relieve the constant stress in the bearings.

A few "DO NOTS" offered by Bearings, Inc., Cleveland, are pointed up in a unique reminder chart packed with repair jobs sent out from this company. The cartoons from this chart reproduced here are well worth a few minutes serious study and diligent application of their suggestions in the future.

Occasional spindle problems occur in spite of all efforts to avoid them. Should "preventive medicine" fail to keep valuable equipment in operation while expensive down time threatens, the second best measure is prescribed: cure the existing ailment.

This is easier said than done. An inexperienced repair man might tackle your precision instrument with all the lust and ignorance of a genuine punch-and-hammer artist. Later complaints are likely to be attributed to faulty precision bearings.

Past experience has proved that in most such instances, it was not the fault of precision bearings when repairs failed to cure the spindle problems. More often, it was incorrect bearings being used in the first place. Sometimes the bearings were not mounted correctly, the shop conditions were not favorable to precision repairs, or the repair man had little regard for proper shaft and housing tolerances.

All this comes from a naive belief that the replacement of bearings will cure most troubles. That is far from the truth. Perhaps, it is the least of the complex details involved in correct diagnosis and repair of spindle troubles.

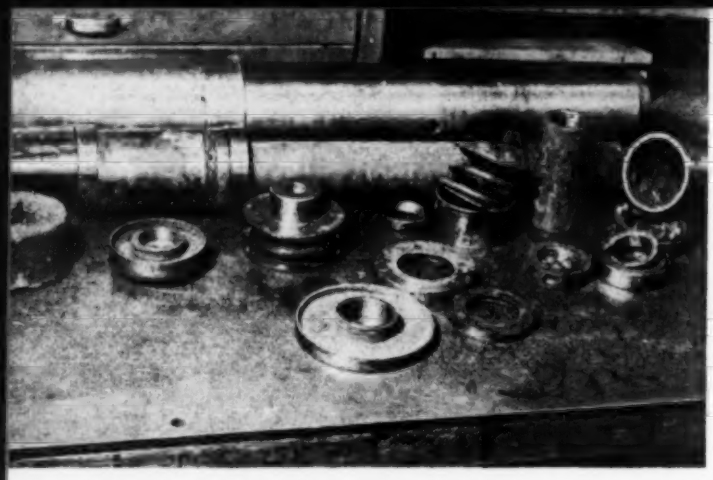
The correct procedure is very much like the examination and treatment of a human patient whose symptoms might indicate any one of a number of troubles to the practiced diagnostician. A spindle must be carefully disassembled and all parts carefully cleaned for inspection. The preliminary examination makes obvious the need for replacement of any damaged parts.

Rebuilding of the spindle should be done under ideal conditions with precautions against abnormal humidity, temperature, and dust. Particular attention should be given to the shaft, housing, spacers, and locking nuts. If the spacers and locking nuts are not square they will additionally pre-load the bearing or distort the shaft.

Replacement bearings must be carefully selected for correct preloading. But, the problem may not be in the bearings at all. Bearing seats may be worn. New bearings won't help this situation unless the shaft is restored to accurate size.

The shaft must be checked to insure proper tolerances at all bearing surfaces. They may not only be undersize from wear but may also be out of round. Shaft shoulders must be square to bearing surfaces. Quill type shafts should be checked with master quills for runout. Wheel screw threads must be clean and undamaged. In many instances, badly worn shafts can be rebuilt at a considerable savings, but where shafts cannot be salvaged properly, they should be replaced.

Housings must be checked against

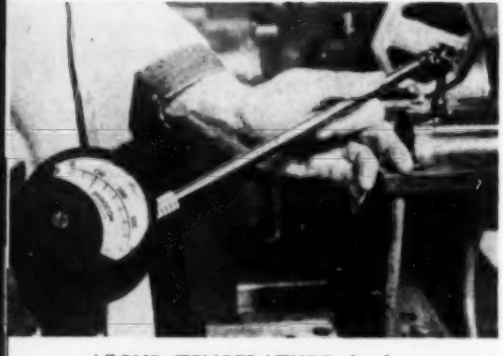


BEFORE—ALL PARTS are carefully laid out.

AFTER—SPINDLE parts ready for reassembly.

Care of Grinding Spindles . . .

RUST AND SLUDGE inside the housing.



ABOVE, TEMPERATURE check on reconditioned spindle. Below left, shaft checked for runout. Below right, speed test.

wear on the ID, and shoulders for squareness. All spacers should be checked for squareness and parallelism. The same applies to locking nuts and slinger.

Correct fitting is only one factor in bearings. They also must be selected for the proper operating speed of the spindle to insure maximum spindle rigidity. Before assembly, bearings are cleaned and blown out with clean, dry air. Sealed units are hand packed with special spindle lubricant. Overlubrication can cause a block, or a hot spindle.

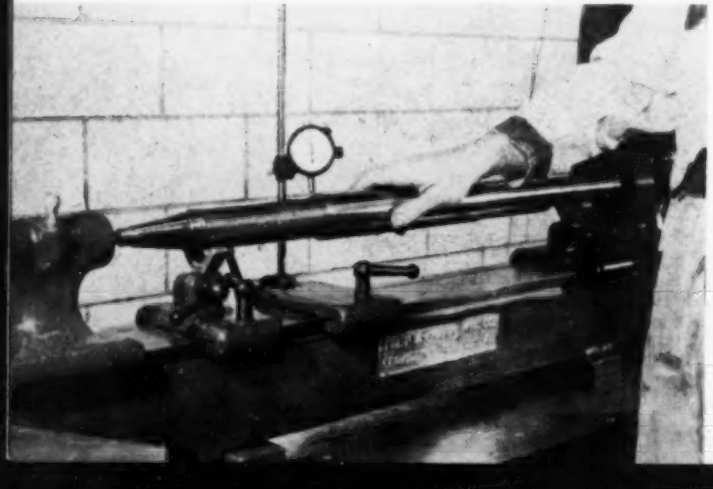
Bearings often can be mounted in different ways, depending on the construction of a spindle. Therefore, they must be carefully reassembled and mounted correctly.

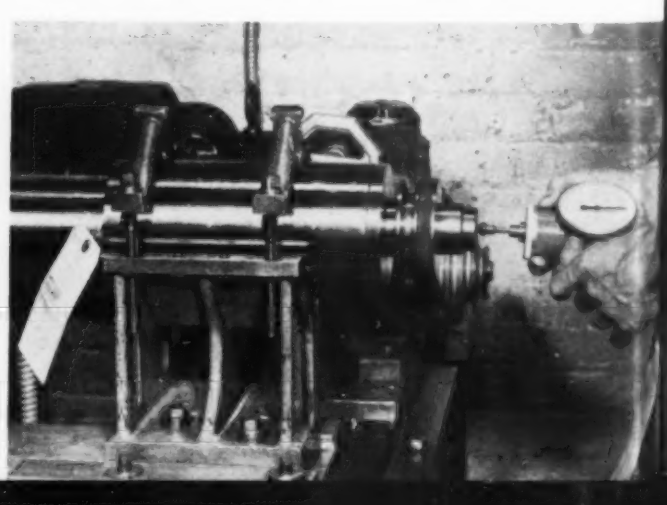
This does not complete the job. A spindle cannot be reinstalled and run on production work immediately after repairs without the risk of further damage. The newly repaired spindle must be "run in" with a variable speed drive, gradually worked up to full RPM with close observation of speed and running temperature.

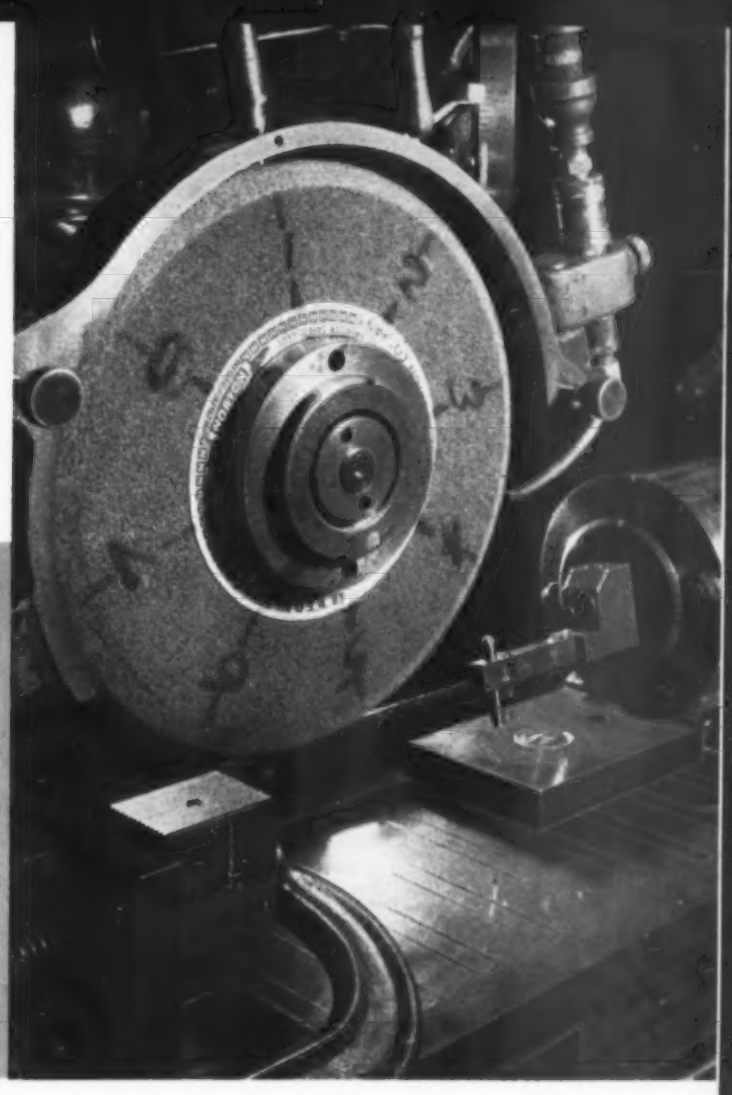
A final check should prove the running truth of quill and pulley. The last mechanical repair should be balancing to insure against vibration in the repaired spindle before it is put back into service.

Few maintenance or repair shops are properly equipped to handle this kind of job. Those which are may still sacrifice desired precision for the expediency of saving time or trouble. That is why many spindle problems have been falsely attributed to bad precision bearings instead of bad precison repairs. That is why a complete spindle repair service was set up at Bearings, Inc.

While many will agree that the spindle is the heart of a grinder, they seem to overlook the fact that this mechanical "heart" is very different from its equivalent in human anatomy. It can only become worse with wear and misuse. Give your spindle the care it deserves. Second to this, see that precision repairs are made under the practiced eye of an expert. ● ● ●







When the right conditions of abrasive, fluid and machine settings are used, titanium grinding is generally no more difficult than most steel grinding jobs. Here are results from Thompson Products' manufacturing research studies of belt polishing, internal grinding, and form grinding operations.

Titanium Grinding

By **L. C. Hays,** staff industrial engineer
Manufacturing Research Department
Thompson Products, Inc.

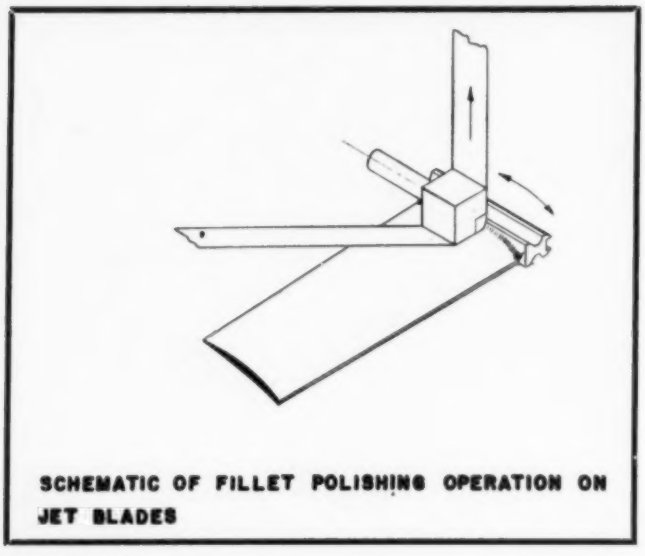
● Titanium grinding has progressed rapidly since first attempts were made several years ago. When titanium metal became commercially available, the fabrication techniques used on steels and other metals were applied to finish it. When steel grinding procedures were applied to titanium grinding, results were generally unsatisfactory. In most cases, more abrasive was removed from the grinding wheel than stock was removed from the titanium. Burning and smearing of the metal also occurred. These results showed that considerable research would be required to grind titanium satisfactorily in production.

The main reason for the unsatisfactory results on grinding titanium can be attributed to the great affinity of titanium for other elements at high temperatures. Titanium becomes chemically active at high temperatures and actually reacts with the abrasive grains of the grinding wheel. Unless the chemical reaction can be inhibited by some means, the grinding wheel loss is high and the titanium becomes burned and smeared. When proper grinding conditions are used, the chemical reaction is minimized and the grinding wheel loss results only from the mechanical action between the titanium and the abrasive grains.

Whenever possible, the experimentation required to set up new titanium grinding operations should be done in the laboratory on controlled tests. This is not always possible, but where time and the economics permit, the laboratory is the place to do most of the basic experimenting. Often the results of other experimenters or the results from other production operations can be used as a guide in setting up new production operations. Let's consider some of the typical jobs we have encountered on titanium aircraft parts.

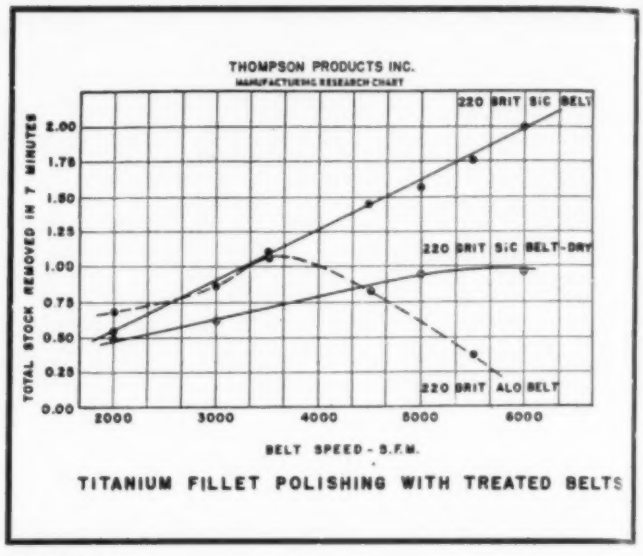
Belt polishing operations

Belt polishing of titanium was originally performed with dry belts; however, frequent fires resulted. Belt polishing or grinding of tita-



SCHEMATIC OF FILLET POLISHING OPERATION ON JET BLADES

FIGURE 1



TITANIUM FILLET POLISHING WITH TREATED BELTS

FIGURE 2

TITANIUM GRINDING...

nium should be done wet when possible. The danger of fires is ever present with belt operations on titanium, but with good housekeeping and care in setting up each operation, the danger can be minimized. Titanium dust is combustible and should not be allowed to collect. Cleanliness is a must and a routine should be established to keep each area policed. The cleaning should include the dust collector system with particular attention to the horizontal runs and bends. Wet collectors should be used on every production belt grinding operation.

Figure 1 is a schematic of the fillet polishing of titanium jet blades performed as a hand operation by female operators. The area being polished is in the section where the blade airfoil blends with the root section. In setting up the titanium operation, the belt speed was reduced from 6000 sfm used on the polishing of steel blades to 1800 sfm. Even with the low speed, fires occasionally occurred and belt life was low.

To improve fillet operation, a fillet polishing machine was removed from the production line and installed in the Manufacturing Research area. A variable speed attachment was installed on the polisher. Since sufficient scrap blades were not available for the tests, a set-up was designed and made to use one-half inch round rods of titanium. By using the special set-up, the pressure between the test samples and the belts was held constant and approximated the operator's hand pressure. Each test was run for a prescribed length of time and each test sample was weighed before and after each test to determine the stock removal rate. Surface finish measurements were made during each test.

An experimental fluid for improving titanium belt polishing was evaluated on the fillet operation. Initially, the fluid was applied by dipping the belts and wiping away the excess. This expedient was used because of the unavailability at that time of a sprayer capable of spraying the polishing fluid. The viscosity of the fluid was 3600 sus at 100° F with a flash point of over 400° F. Later in the project, a sprayer was designed and fabricated to spray the fluid.

Figure 2 compares the stock removal rate for dry and treated silicon carbide belts and treated aluminum oxide belts at various speeds on Ti 150A titanium. The 220 grit silicon carbide belts were the standard production belts for the fillet operation. The aluminum oxide abrasive reacted with the titanium as the speed was increased, and above 3500 sfm, the stock removal rate dropped off. The treated silicon carbide belts continued to give greater stock removal as the speed was increased. At 5000 sfm, the treated belts gave a 100% improvement in stock removal and a great improvement in finish over dry belts. Similar tests were also made on 6AL-4V titanium where a 70% improvement in stock removal and a great improvement in finish resulted.

Figure 3 compares stock removal for dry and treated silicon carbide belts at 6000 sfm and treated aluminum oxide belts at 3500 sfm. The abscissa on this slide is the accumulated wear. Figure 4 illustrates the type of finish obtained on titanium at high speeds. The left photograph shows the orange peel effect resulting from dry grinding, while the photograph on the right shows the good finish resulting from the use of a suitable fluid. The horizontal line was made by the stylus of the surface roughness meter.

At the conclusion of the laboratory tests, production tests were made with the belt polishing fluid using dipped belts and sprayed belts. With the production speed of 1800 sfm, a 33% improvement in belt life was realized. The spray process has now been installed on all our titanium fillet polishing machines, and a reduction of 30% in belt costs has resulted. It is expected that further cost reductions can be made by increasing the belt speed and by developing more efficient polishing fluids. The dust

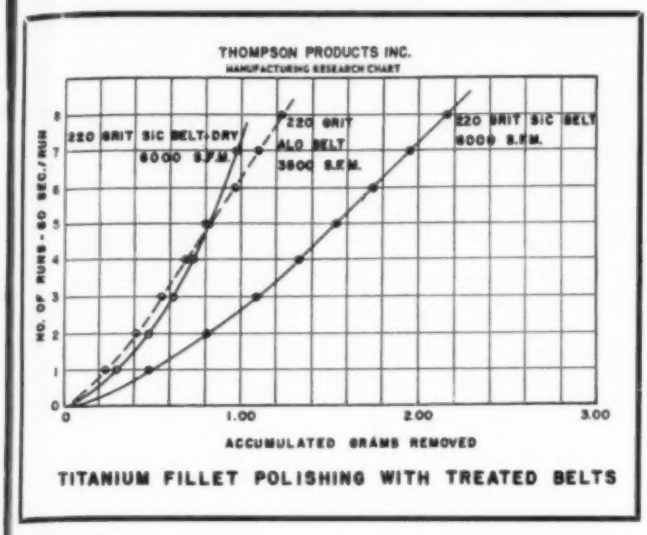


FIGURE 3

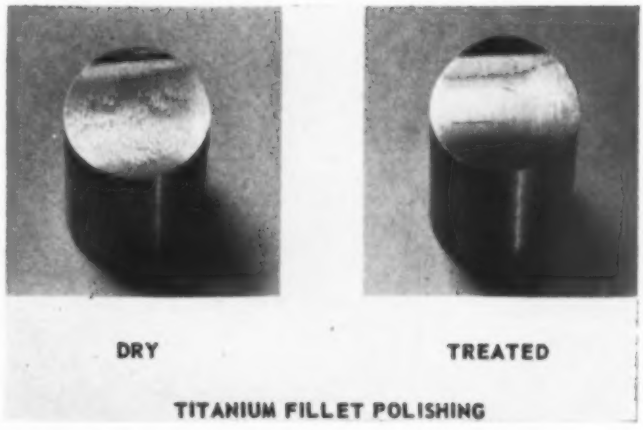


FIGURE 4

and fire problems have also been greatly reduced by using the sprayer system. When the operator installs a new belt on the machine, the sprayer is operated for a few seconds. The fluid applied during that time is sufficient for the life of the belt.

The belt polishing fluid was also evaluated on the swirl polishing of titanium extrusion cones. Figure 5 shows a schematic of the operation, where 60 grit silicon carbide belts were used to polish the extrusions prior to forging. Poor belt life and occasional fires were the principal problems. With belts dipped in the fluid, belt life was increased 35% and the spark intensity was greatly reduced.

Many belt polishing operations have been converted from dry operation to wet operation by using reservoirs beneath the belts and a sprayer applying a rust inhibitor and water solution to the belts at the back stand idler. These set-ups have reduced the titanium dust and fire problems.

Internal grinding operations

The second grinding operation to be discussed is the internal grinding of RC 130B titanium. On one production internal grinding operation, the problem was to grind one-half inch holes to a total tolerance of 0.0003" for a hole length of 1¾". To improve the operation, tests were made in an internal grinder to determine the best procedures to produce the desired hole dimensions. In production, the pieces were being ground with mounted diamond wheels, and production was low. Time was lost in truing the wheels because the wheels had to be indicated after installation. An internal wheel and a facing wheel operation were required in the same set-up. Thus the diamond wheels had to be removed after each operation was completed. Diamond costs were also high. With aluminum oxide wheels, the wheels were trued-up by diamond dressing. Figure 6 illustrates the results of the tests with two aluminum

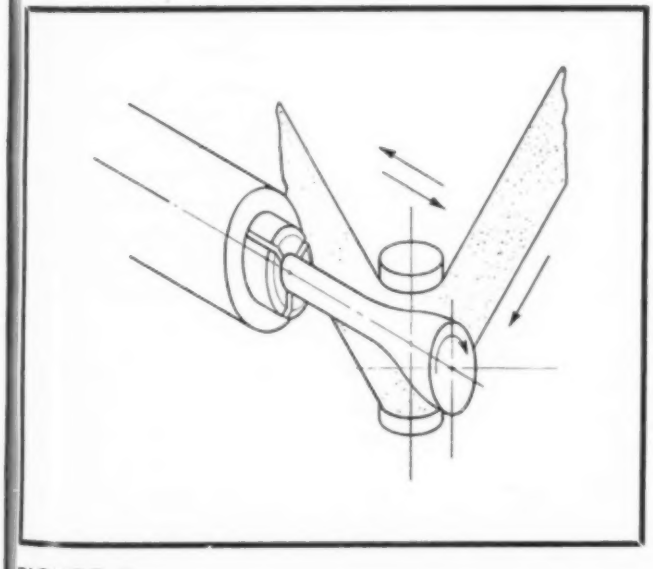


FIGURE 5

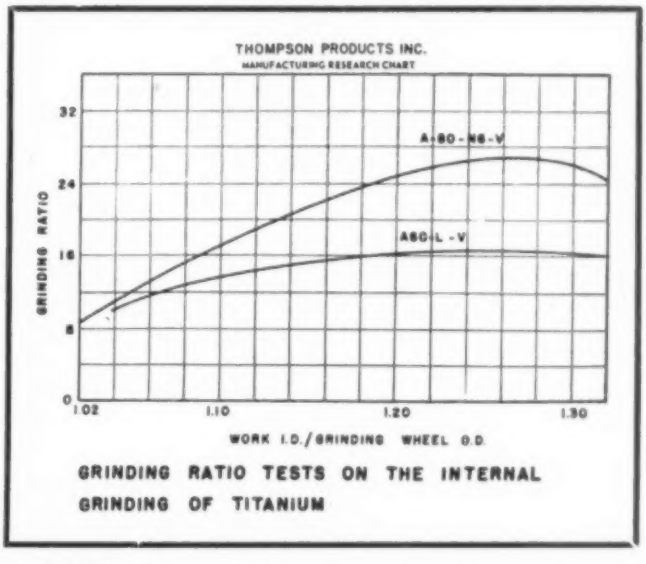
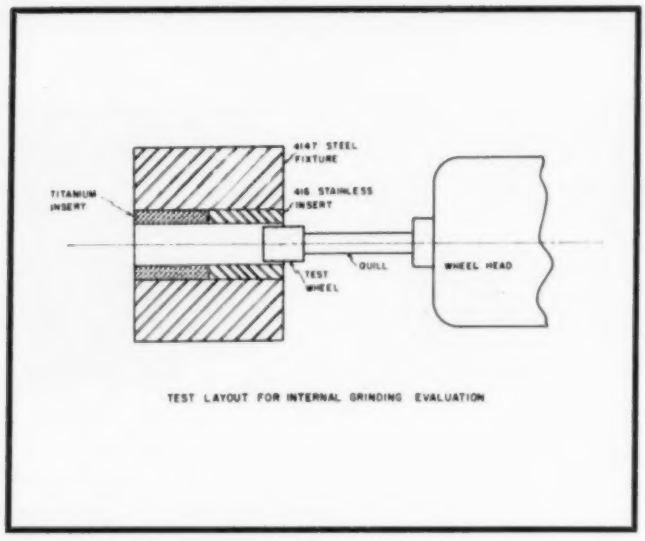
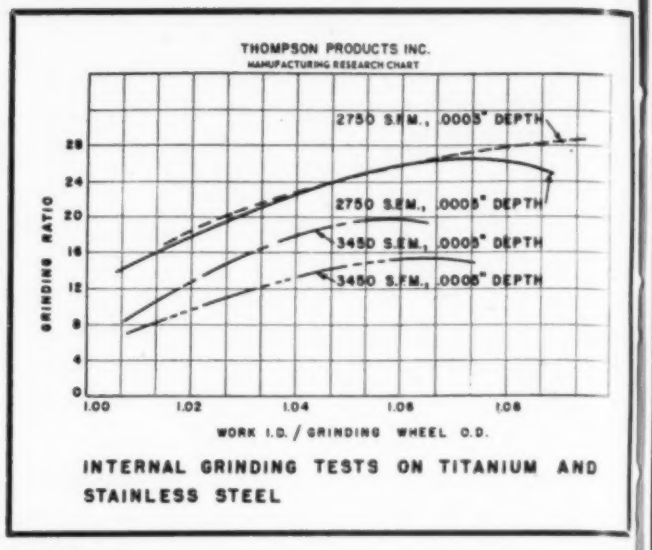


FIGURE 6



TEST LAYOUT FOR INTERNAL GRINDING EVALUATION

FIGURE 7



INTERNAL GRINDING TESTS ON TITANIUM AND STAINLESS STEEL

FIGURE 8

TITANIUM GRINDING . . .

oxide wheels at various ratios of work i.d. divided by wheel o.d. The grinding ratio is the volume of titanium removed per unit volume of grinding wheel used. For these tests a nitrite-type water solution was used with aluminum oxide wheels. Hole tolerance was held to 0.0001" taper with no bell mouthing. On several tests, a taper was deliberately put into the work i.d., and no difficulty was experienced in removing the taper. The resulting surface finish was eight microinches. As the grinding wheel diameter was reduced by wear and by dressing, and the hole diameter increased due to removal of the metal, the grinding ratio increased. At a work i.d. divided by wheel o.d. ratio of 1.24, the maximum grinding ratio of 27 was attained. Beyond that point, the grinding ratio dropped off. For these tests, wheel speeds of 7,500, 14,000 and 17,500 rpm were used, with the best results obtained at a wheel speed of 14,000 rpm, 0.005" depth of cut (on diameter), 190 rpm work speed and with a wheel traverse speed of 30 inches per minute.

Titanium and stainless in combination

The third grinding operation to be discussed is the internal grinding of RC 130B titanium and stainless steel in the same operation. Figure 7 shows a schematic of the set-up used for this evaluation. The desired hole size was 0.7803"-0.7805" for a bore length of 2¾". Figure 8 shows the results with three-quarter inch diameter A80-N6-V signature aluminum oxide wheels and a nitrite-water solution. The addition of the stainless steel inserts did not alter the expected results. Normally a higher grinding speed could be used on the stainless steel, but since titanium requires a lower speed, the speed was adjusted in favor of the titanium. From the slide, the grinding ratios were higher with the 14,000 rpm (2750 sfpm) wheel speed than with the 17,500 rpm (3450 sfpm) wheel speed, with an average increase of 60%. Lower speeds may have given better grinding ratios, but lower speed spindles were not available. The hole tolerance was held to less than 0.0002" taper with no bell mouthing, and the surface finish was eight micro inches on the titanium and stainless steel. This operation is not currently being performed in production because of a change in the design of the finished part. The information gained, however, is useful for other operations where titanium and other metals must be ground at the same time.

Form grinding

The fourth grinding operation to be discussed is on the form grinding of titanium. The ultimate goal of this project is to be able to grind the root form section of titanium jet blades in production.

The test procedure used consisted of form grinding on a variable speed surface grinder with wheels dressed to a 60° truncated "V" shape as shown in Figure 9. A close-up of the actual test set-up is shown in Figure 10. The titanium test block, precision wheel dresser, grinding wheel and measuring micrometer are visible in the photograph. This form was adopted for these tests because of the ease of reproducibility of the form on the wheel and simplicity of checking the resulting form in the titanium. After dressing, the wheel was fed into the work a prescribed amount on each pass of the reciprocating table. Most of the tests were made with 0.001" downfeed and 300 inches per minute table speed. The criteria used to judge a wheel or fluid's performance were:

1. Depth, shape and surface appearance of the slot produced.
2. Loss of diameter of the grinding wheel.

The grinding ratio was used as one of the main comparison parameters. To compute the form grinding ratio, the surface grinding ratio was divided by a correction factor to account for the dimensions of the form. For the 60° "V" form at a depth of 0.050", the cor-

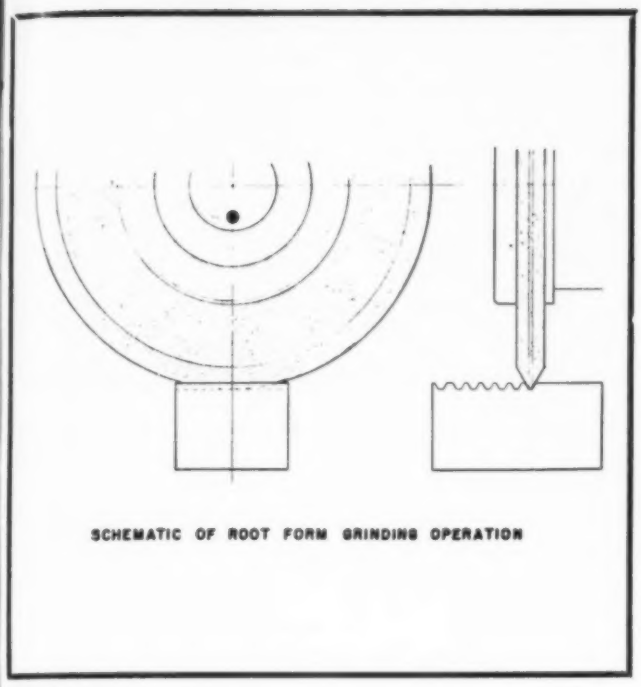


FIGURE 9

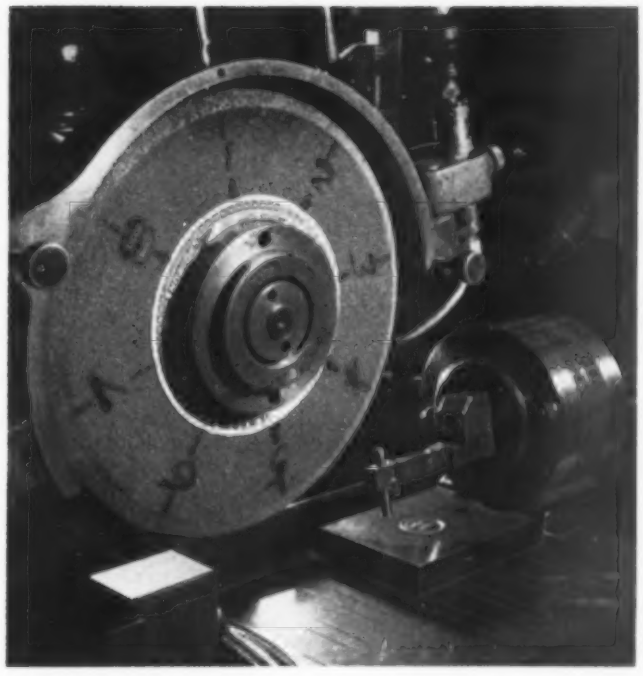


FIGURE 10

rection factor was .511 for a perfect form. The titanium used on these tests was 6AL-4V in the form of 2" x 2" x 3" blocks.

Thirty-two grinding wheels and nineteen grinding fluids have been evaluated on the form grinding tests. The results have ranged from poor to excellent, depending upon the wheel and fluid combination used.

Most of the aluminum oxide wheel tests have been made in the range of 1500-2500 sfm. Indications are that higher grinding ratios might be obtained with lower wheel speeds but the danger of wheel breakage, coupled with bad finish limited the tests to the 1500 sfm minimum. Speeds higher than 2500 sfm with aluminum oxide wheels were tried, but low grinding ratios resulted. Several good aluminum oxide wheels were found in the 60-80 grit size, semi-friable grain and K-L hardness range. On each of the better aluminum oxide wheels, the speed range for maximum grinding ratios was narrow. As shown in Figure 11, the grinding ratio dropped off appreciably on either side of the optimum speed.

Silicon carbide wheels were not as dependent upon speed for optimum performance as were the aluminum oxide wheels. The best operating range for the silicon carbide wheels on the form grinding of titanium was 4000 to 6000 sfm. A flat grinding ratio-wheel speed curve with little tendency toward a sharp peak in grinding ratio was the usual result. A few of the outstanding wheels did produce a sharp increase in grinding ratio in the optimum speed range. With each silicon carbide wheel, the form-holding ability decreased as the wheel speed was reduced. Several good silicon carbide wheels were found in the 60-80 grit size and 1-K hardness range. Figure 12 shows the results of several grinding fluids with one of the better silicon carbide grinding wheels. Fluid number one in this figure and in Figure 11 was the same fluid described on the belt polishing tests. For the grinding wheel evaluations, the fluid was applied with a brush to the titanium block on each stroke of the machine table. The other oils can be identified as follows:

a) No. 2–Synthetic base oil with 8% sulphur, 8% chlorine and a viscosity of 366 sus at 100° F.

b) No. 3–Solvent extracted mid-continent base oil with 2% sulphur, 4% chlorine and a viscosity of 200 sus at 100° F.

c) No. 4–Mineral base oil, with 4½% chlorine, 2½% sulphur and a viscosity of 200 sus at 100° F.

The importance of the grinding fluid to the grinding of titanium is illustrated in Figure 12. Oils No. 3 and No. 4 have essentially the same percentages of chlorine and sulphur, but the performance of oil No. 3 is several times that of oil No. 4. The chemical activity of the compounds used in the grinding fluid has a great bearing on the performance of the grinding operation. Buying grinding fluids for titanium grinding is more than just specifying the percentages of the desired constituents.

Figure 13 compares the speed range of aluminum oxide and silicon carbide wheels. The fluid used in this comparison was again the belt-polishing fluid. The silicon carbide wheel peaks in grinding ratio at a higher speed than the aluminum oxide wheel and levels out at a higher grinding ratio.

Slight changes in the grinding wheel can have a marked effect on the performance in titanium grinding. For example, two aluminum oxide wheels from the same manufacturer with the same signature, but from different lots, gave a variation of maximum grinding

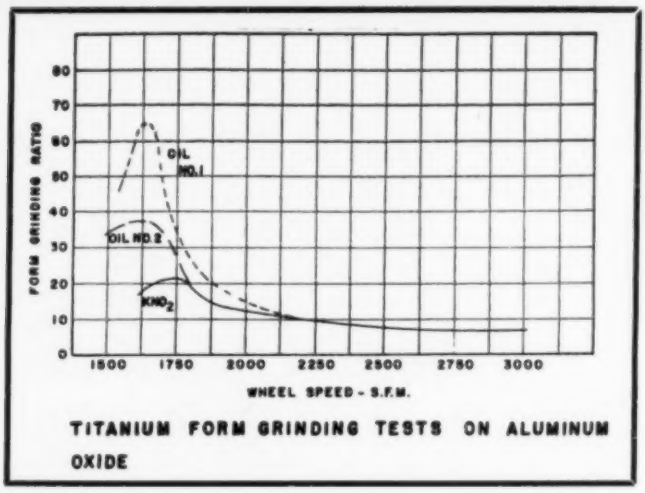


FIGURE 11

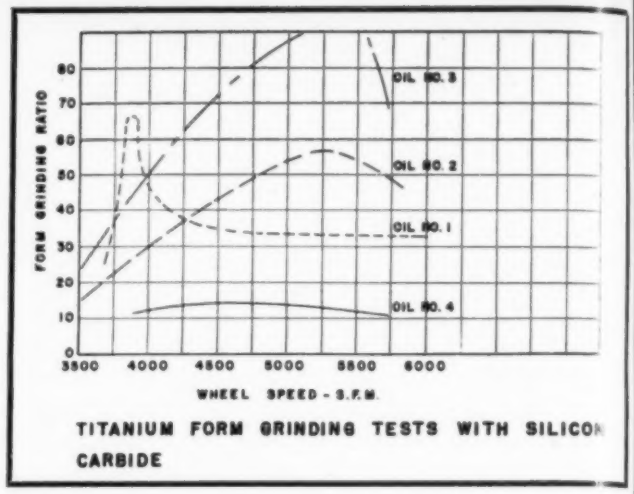


FIGURE 12

ratio of 160 per cent. Two silicon carbide wheels from the same manufacturer with the same signature, excepting that one wheel was 60 grit and the other wheel was 80 grit, gave a one hundredfold variation in maximum grinding ratio. Another manufacturer supplied two silicon carbide wheels with the same signature but from different lots and the maximum grinding ratio varied by 500 per cent. These examples illustrate that close tolerances during manufacture must be held on the grinding wheels to get consistent results. Within each lot from a manufacturer, the wheels tested generally were quite consistent. A greater variation will, of course, be found in trying to compare one company's wheels with another company's wheels in the same signature. The grading procedure, type of grain, type of bond, etc., will vary from company to company. In order to specify a company's wheels for a particular titanium grinding operation, tests should be made to determine the best performing wheels from that company on the operation.

The effect of wheel hardness on the grinding performance is illustrated in Figure 14. The grinding ratio increases sharply with the 80-grit wheel as the wheel hardness goes from J to K. This sharp increase might be attributed to the wide hardness range covered by each letter hardness in the soft and medium hardness ranges. If for example, for the 80-grit tests, the K wheel was at the high end of the K hardness range and the J wheel was at the low end of the J hardness range, a hardness span of almost two letters would be covered. This indicates that wheels may have to be purchased using plus and minus qualifications on the specification (e.g., J+, K–).

Preliminary tests have been made on the grinding of titanium, using the electrolytic grinding process. This process is applied to a conventional grinder to assist in the metal removal by electrolytic deplating of the metal being ground. The work in this case was done on a six-inch oscillating carbide tool grinder with a plate mounted 120-grit metal bonded, diamond wheel and equipped with a 300 Amp. electrolytic power supply.

Stock removal rates of 0.155 linear inches per minute on one-half inch round bars of 150A titanium were made with the resulting surface finish in the range of 17 micro inches. The pieces were cool even after five minutes of continuous grinding. Wheel wear was much higher than when the same process was used to grind carbide tools, because the titanium attacked the metal bond and released the diamond particles at an accelerated rate.

• • •

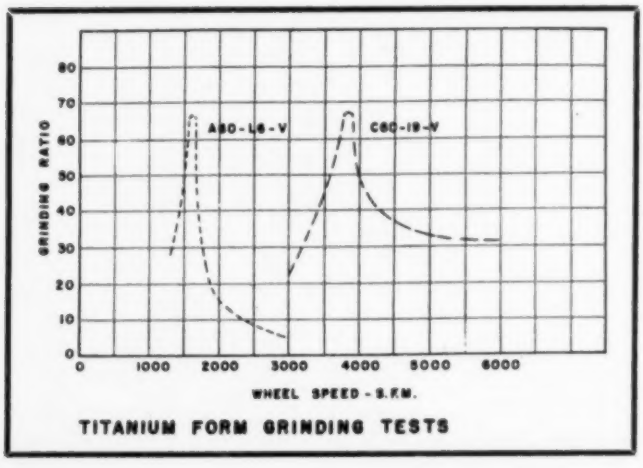


FIGURE 13

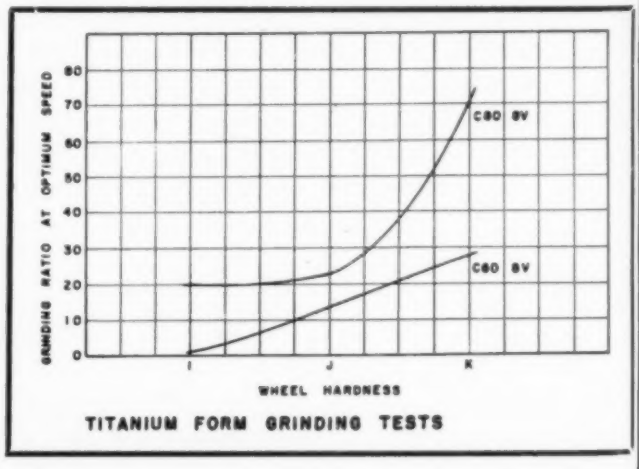


FIGURE 14

Metal removal *faster* at lower cost

CHICAGO MOUNTED WHEELS

Prompt Out-of-Stock Deliveries

There is a precision-engineered Chicago Mounted Wheel or point for every imaginable grinding operation. Ideal for efficient, effective deburring. . . . Always available . . . in all standard sizes, and over 200 special shapes, for out-of-stock delivery. Save Time – Money – Materials . . . Specify Chicago Mounted Wheels!

Every Chicago Mounted Wheel is produced under positive production control . . . assuring perfect uniformity of mounted wheels and points. There is no variation from one production run to another.

Positive density control for peak job performance

Guaranteed to stay on the mandrel . . . perfectly balanced

Chicago Mounted Wheels are easily dressed and hold their shape

Unlimited number of combinations of dimension, shape, grain, size and bond

WRITE FOR *Trial* CHICAGO WHEELS

Test them yourself!

Send coupon for two Chicago Mounted Wheels . . . Test one against the other . . . you'll see the meaning of true uniform performance!

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1101 W. Monroe Street • Chicago, Illinois

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City _____ Zone _____ State _____

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New "SPUR-ACTION" abrasive belt cuts 25% Faster.

Removing excess material from a cast brass spring housing for a pressure reducing valve is fast and easy with a new "81-Coat" Resinall Metalite abrasive belt. The new Behr-Manning abrasive belts not only do a faster stock removal job but also stand up longer than any previously used.

's *Abrasive Tech"—*

BEHR-MANNING CO., TROY, N. Y.

☐ Please have a Field Engineer contact me to arrange for a demonstration of your new "81-Coat" belts and discs.

☐ At my plant ☐ At your nearest "Abrasive Tech" Branch Methods Room

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Company _____

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City _____ *Zone* _____ *State* _____

"81-COAT" Abrasive Belts and Discs outlast all others by as much as 50%

From the Research Laboratory of Abrasive Tech comes an entirely new way of making coated abrasives—"81-Coat."

It gives a new toughness . . . a new sharpness to abrasive belts and discs. It gives them "Spur-Action"—hundreds of rougher, tougher cutting "spur" points per square inch for fastest stock removal.

And for greater endurance, greater resistance to grinding heat, and longer life, it provides the strongest resin bond ever attained for abrasive belts and discs.

Feel the difference . . . see the difference . . . profit by the difference. Just mail the coupon to arrange a demonstration of new "81-Coat" belts or discs on your toughest job . . . to spur more production, more mileage per belt—*at no increase in price!*

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Every grinding wheel user should be familiar with the Grinding Wheel Institute's booklet on standard shapes and sizes of grinding wheels. The 1957 revision has just been issued. Still without the force of an ASA standard, the recommendation will nevertheless eliminate a great deal of waste if it's followed by wheel users and machine tool builders in setting up new grinding operations. Standout features of the latest version:

- Greater emphasis on the "end use" classification of wheels, for the specific benefit of machine designers.
- Addition of six new wheel shapes now in general use.

What's behind the new

Standard Practice Recommendation for Grinding Wheels

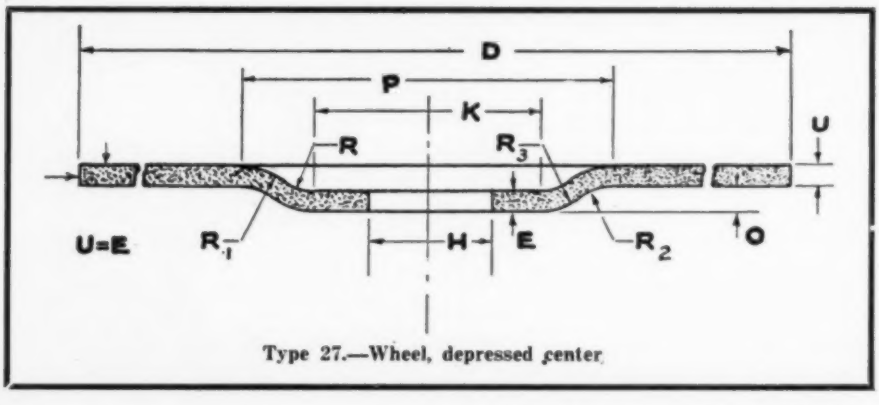
By **Jack Kenyon,** managing editor

● How is the user of grinding wheels affected by "Simplified Practice Recommendation R45 - 57," dealing with standard shapes and sizes of grinding wheels? Is the new revision of the recommendation, just issued by the Grinding Wheel Institute, a radical departure from the 1947 edition? Does it involve the addition or deletion of very many shapes and sizes? And, does the recommendation have the force or effect of a true standard in making the practices mandatory for American industry?

GRINDING AND FINISHING went to wheel manufacturers, distributors and users to gage the impact of the newly issued recommendation on American metalworking operations.

The first thing we learned is that the recommendation doesn't have the force of a true ASA Standard. It does represent the current thinking of grinding wheel manufacturers, many machine tool builders and industrial distributors as a means of eliminating avoidable waste in the use of grinding wheels.

The latest revision is the seventh



Type 27.—Wheel, depressed center

THE POPULAR depressed-center disc has been added as Type 27 to the list of standard types in the 1957 Recommendation.

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Left to right: Miss Mary Peters, of the IBM section in Hitchcock's Fulfillment Department, and Herb Sterling, Department Manager, explain the details of the Hitchcock circulation operation to Ken Wells, well-known in national industrial advertising circles and an executive officer of Besly-Welles.

THE MAN FROM HITCHCOCK

Ken Welles, of Besly-Welles Corporation, a leading supplier to the metalworking industry and a regular advertiser in Hitchcock metalworking publications, recently supplemented Besly-Welles' advertising schedule with a direct-mail program. Through the use of Hitchcock's modern, accurate IBM and Scriptomatic Addressing systems, Ken was able to scientifically select those companies to whom he wished to mail: by S.I.C. classification and geographic selection, as well as, individuals by name and title.

Hitchcock publications and services—to supplement and "merchandise" their advertising—provide suppliers of the metalworking, woodworking and public passenger transportation industries with a direct line of communication that is natural to their customers and prospects and efficiently productive for the advertiser. Hitchcock, with their S.I.C. system and B.P.A. audited, verified circulation, is always ready to direct your message to your select buying and specifying influences with pinpoint accuracy.

THE MAN FROM HITCHCOCK, whether he is a space representative, an editor or a circulation staff member, is always at your call . . . eager to help you. *Call* or *write* for friendly, competent information or assistance.

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Hitchcock's Wood Working Directory

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THE PIONEER OF CONTROLLED CIRCULATION

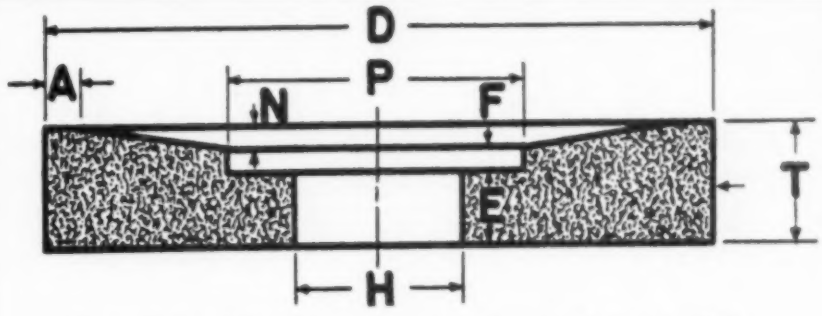
Standard Practice Recommendation for Grinding Wheels . . .

version of the recommendation, which was first issued by the Grinding Wheel Institute, official trade association of wheel manufacturers, in 1925. The recommendation was the result of the extreme over-diversification in grinding wheel manufacturing with respect to the number of shapes and sizes produced. Even the first issue of Recommendation R-45 accomplished a monumental reduction in the number of styles and sizes offered, from a staggering 715,000 to a more reasonable 255,000 varieties. Subsequent revisions have reduced this figure still further, with attendant economies in manufacturing, distribution and use of wheels.

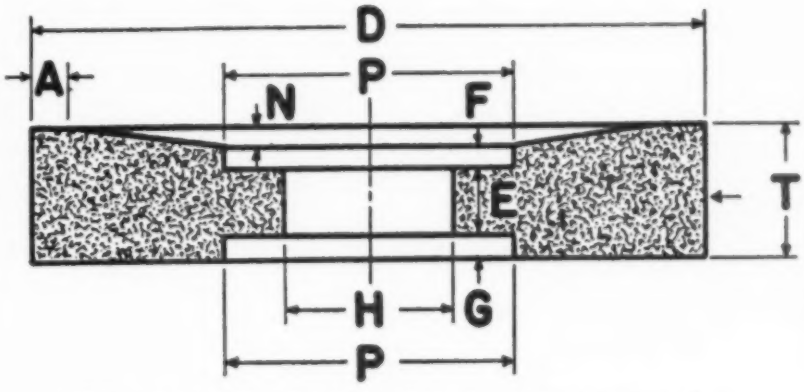
As the demands of industry practice have changed, some styles of wheels have fallen by the wayside, and others have had to be added. An important innovation of the 1947 Recommendation was the addition of a part of the booklet devoted to classifying wheels by their end use in different types and sizes of grinding machines. This portion of the recommendations has proved to be very valuable to the designers of machine tools, and has been given greater prominence in the current revision, where it's been placed in the front of the book.

The eventual aim of the Grinding Wheel Institute is the establishment of an official American Standard on the subject of wheel shapes and sizes. With the current revision, the industry has moved a bit closer to that goal. Cooperation of machine tool builders on the subject of standard wheels has apparently developed to a considerable extent in the past few years, an important factor in the movement toward a true industry-wide Standard.

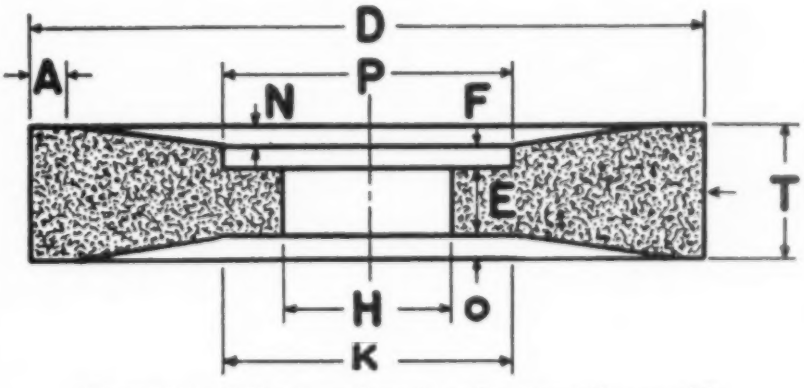
We checked the list of acceptors of the new recommendation



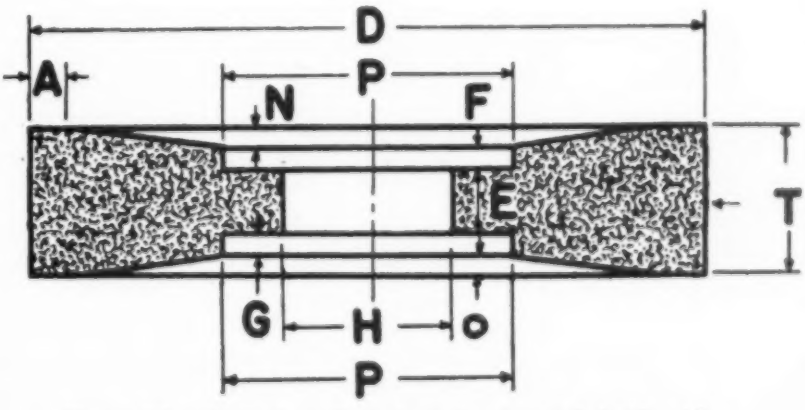
Type 23.—Wheel, relieved and recessed same side.



Type 24.—Wheel, relieved and recessed one side, recessed other side.



Type 25.—Wheel, relieved and recessed one side, relieved other side.



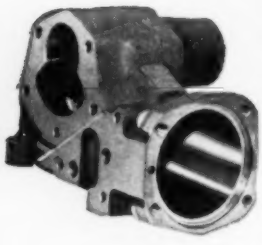
Type 26.—Wheel, relieved and recessed both sides.

TYPES 23 THROUGH 26, added in the new revision of the Standard Practice Recommendation, reflect the trend to wheels for grinding multiple surfaces in one operation.

Why MICROHONING

Is Final Stock Removal Process For Interrupted and Blind-End Bores

To secure low-cost, final stock removal, that generates accuracy and functional surface characteristics in a variety of bore conditions, a leading manufacturer of power steering assemblies uses Microhoning. Here are details concerning types of bores and stock removal results obtained by using Micromatic "Know How"—

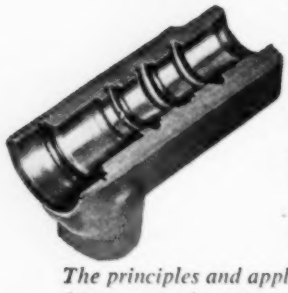


STEERING GEAR HOUSING—Microhoning consistently corrects cumulative inaccuracies of preceding operations—reduces scrap—permits faster boring—cuts boring tool sharpenings—lowers down-time and tool costs.

Material: Soft Malleable Iron
Bore: 3.125"D x 6.93"L (Ported bore with ¼" relief at blind end)
Stock Removal: .002"
Finish: 50 Microinches RMS
Microhoning Cycle: 18 sec.
Preceding Operation: Boring

PISTON RACK—Microhoning answers the need for a final stock removal process that generates a controlled surface finish in the bore of this leaded steel part. Microhoned surface (cross hatch) prevents oil leakage and holds to a minimum the wear of seal that operates in the bore.

Material: Leaded Steel (Rockwell 62 "C")
Bore: .875"D x 3"L
Stock Removal: .005"
Finish: 20 Microinches RMS
Microhoning Cycle: 20 sec.
Preceding Operation: Boring and H.T.



VALVE HOUSING—Microhoning consistently holds size and geometric accuracy—meets stringent surface requirements—assures alignment of four lands in bore. Thus, there is no leakage of oil around control valve which is selectively fitted to its housing.

Material: Cast Iron
Bore: .770"D x 2.18"L (Interrupted)
Stock Removal: .0025"
Tolerances: Size .0005"
Roundness .0001"
Straightness .0001"
Finish: 10 Microinches RMS
Microhoning Cycle: 12 sec.
Preceding Operation: Boring

The principles and application of Microhoning are explained in a 30-minute, 16mm, sound movie, "Progress in Precision" . . . available at your request.

☐ Please send me "Progress in Precision" in time for showing on _____(date).
☐ Please have a Micromatic Field Engineer call.
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Standard Practice Recommendation for Grinding Wheels . . .

to see how many grinding machine builders had indicated by their endorsement that they would apply standard wheels wherever possible. Among the top 34 builders, only 10 were listed as acceptors, the remaining 24 presumably having rejected it for one reason or another.

This called for a look into the question of what the objection of a grinding machine builder would be toward the practice of wheel standardization. Individual contact with some of the unlisted builders showed that their absence from the list is more easily attributed to ignorance of the standards, rather than resistance to them. The chief engineer of one builder missing from the acceptor list said he had attempted to use standard wheels as much as possible on new machines, but was still "unable to work completely within those limitations." He pointed out that his company had many machines already in service in the field which demanded special wheels.

A manufacturer of disc grinders said that 85% of their machines required specially designed bolted-on discs not covered by the recommended standard shapes. Still other machine designers displayed an apparent lack of knowledge of the subject of standard wheels.

The progress of grinding techniques since World War II can be traced by a study of the wheel types that have been added in the new 1957 revision. Types 23, 24, 25 and 26, just added, show the trend toward angled head machines for doing grinding of multiple surfaces at one time. They are all of the recessed and relieved types becoming common in cylindrical operations in which a shoulder as well as an OD is being ground.

The addition of type 27, the depressed center wheel for use on portable grinders, reflects the increasing use of that type wheel for removing welds.

The opinion of the grinding wheel manufacturers now seems to

". . . many machine designers showed they were ignorant of standard wheels. It will pay users to be familiar with them.

be that wheel users are sufficiently acquainted with the advantages of standard wheels that they will, to an increasing extent, demand that machine tool builders construct machines around standard wheels. This was confirmed by a call to a volume user of grinding wheels in the automotive industry, who said that their master mechanic section have instructed builders to stick to standard wheels when tooling new grinding operations. He said that the gains in reduced wheel inventory, quicker delivery of wheel orders from the manufacturer or jobber, and interchangeability of wheels between operations made the standard wheel recommendations very worthwhile from their viewpoint.

When the wheel user has a machine from one manufacturer, he's apt to demand that a new machine of a similar type, even from another builder, take the same size wheel, to reduce inventory and simplify purchasing.

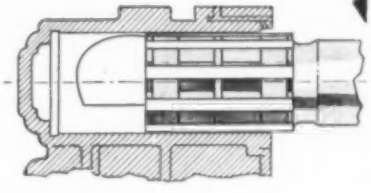
From the wheel manufacturer's viewpoint, of course, the important thing is to standardize on hole size. Any variations in wheel width or diameter can usually be handled by altering a standard wheel, provided the hole diameter isn't special. The user has to keep in mind that by sticking to standard shelf items, his problems of wheel delivery are eased tremendously. And the recommendations take care of the vast majority of applications in the field.

The wheel users that are most affected by standardization are the mass production industries, such as automotive, aircraft, and electrical goods manufacturers, who use great quantities of wheels. If the process engineers of these industries will keep the Standard Practice Recommendation before them as they plan new grinding operations, they are apt to benefit many ways from the use of standard wheels. • • •

How MICROHONING

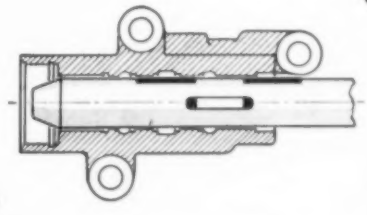
Cuts Costs—Generates Accuracy—Speeds Production of Interrupted, Blind-End Bores

Shown are two Microhoning machines that are used in the plant of a leading manufacturer of automotive power steering assemblies. Machines are equipped with automatic stone feed and stonewear compensating mechanisms, and automatic sizing controls. A two-position rotary fixture is interlocked with machine controls for fully automatic index cycle. The following applications tell more of the "how".



STEERING GEAR HOUSING—In Microhoning the ported, blind-end bore of steering gear housing a nine-stone tool is used. At least six of nine stones are in contact with bore surface when tool passes over irregularly shaped port. Removing .002" of stock from 3.125"D x 6.93"L bore in 18 seconds, Microhoning generates final accuracies and a controlled finish of 50 microinches as specified.

PISTON RACK—In 20 seconds, Microhoning removes .005" of stock from .875"D x 3"L open end leaded steel bore of piston rack. Self-sharpening abrasives assure a consistent generation of specified surface finish of 20 microinches.



VALVE HOUSING—Microhoning tool used for final stock removal in bore of valve housing has one bank of stones and two banks of plastic guides—three stones or guides in each bank. Guides act as tool pilots and stabilizers in interrupted bore—prevent overcutting at edges of lands—assure straight bore by keeping tool aligned. Self-dressing abrasives consistently generate geometric accuracy of .0001" and surface finish of 10 microinches.

Microhoning economically removes stock—corrects cumulative inaccuracies of preceding operations—reduces scrap—permits faster boring—lowers machine tool downtime and maintenance to cut costs and speed production.

Send Coupon for Complete Information

Learn how Microhoning will give efficient stock removal, closer tolerances, accurate alignment and functional surfaces.

☐ Please have a Micromatic Field Engineer call.
☐ Please send Micromatic literature and case histories.

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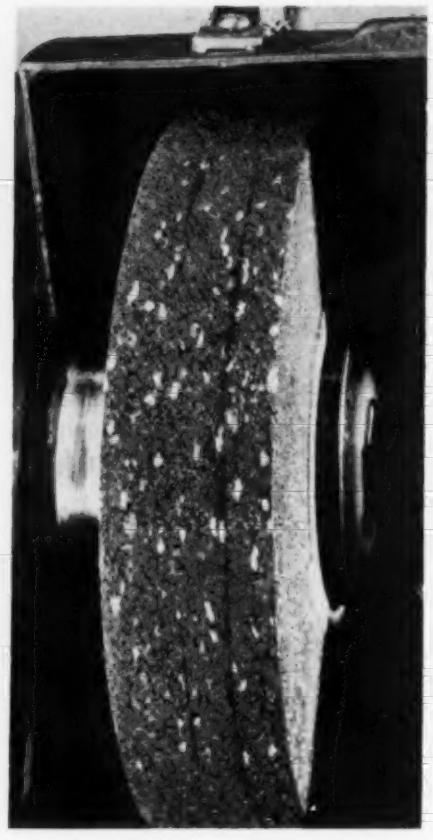
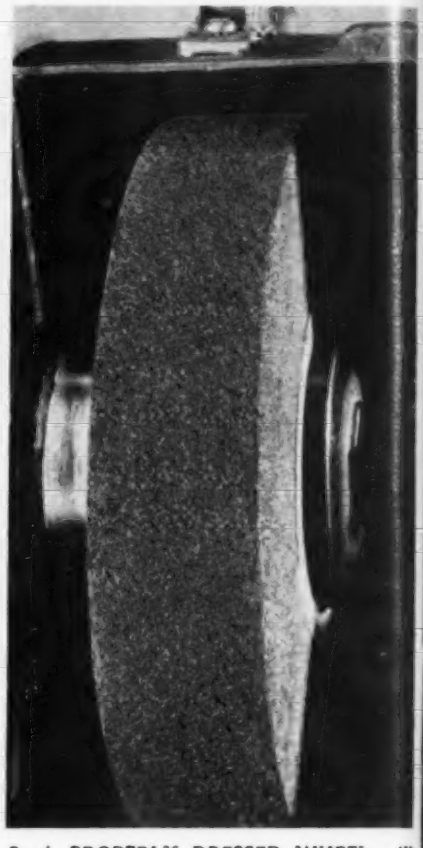
Know the difference between dressing and truing, and select and use your hand-applied dressers for maximum effectiveness. Here are some valuable tips that will make a difference in your dressing efficiency.



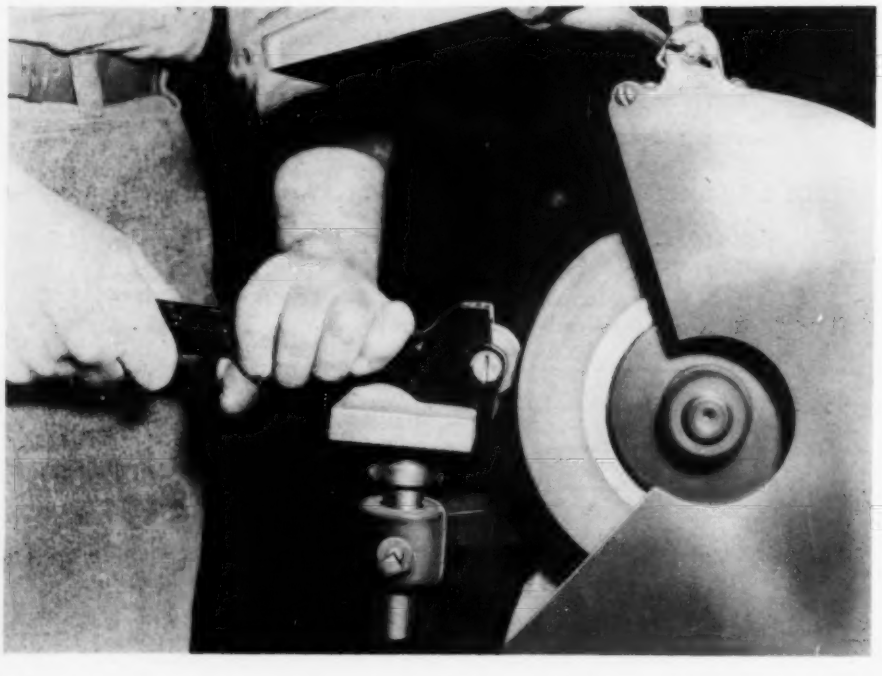
1. THIS WHEEL IS LOADED with particles and scored so badly that accurate grinding is impossible. Truing and dressing should be done long before a wheel gets into this condition.



3. A PROPERLY DRESSED WHEEL will have a true face, clean "pores", and sharp grit exposed for fast, accurate grinding.

How to get the most from

Hand-Applied Dressers



2. PROPER DRESSING means good coordination with your hands. Make the cutters dig in by lifting your right hand as a lever. Control the cross travel with your left.

by **Robert S. McConnell,** president
Desmond-Stephan Manufacturing Co.

● Proper truing and dressing of grinding wheels is more important today than ever before, in holding production costs down.

The very nature of their construction and use makes grinding wheels pick up particles which become deeply imbedded between the grains of abrasive. And, the grinding action alters the face of a wheel and dulls the abrasive. A wheel will not last very long or give satisfactory service with-

(continued page 54)

Make every cent of your
GRINDING WHEEL DOLLAR COUNT
with MACKLIN "Wheels of Profit"
Whatever the grinding job . . . tool sharpening, surface grinding, cylindrical grinding, or metal cut off, you'll find a Macklin tool room wheel of the right type, the right size, the right abrasive and bond.
The reason? Macklin's abrasive experience and modern-as-tomorrow productive capacity. Each wheel is expertly engineered and precisely manufactured to assure you top results, wheel after wheel, job after job.
Job-test a Macklin wheel in your plant.
Reach for the phone and call your Macklin distributor.
You'll find IT PAYS to know him well.
V-8
NEW!
Macklin's V-8 Wheel is tops for all carbide grinding. Test it on your job today. WRITE
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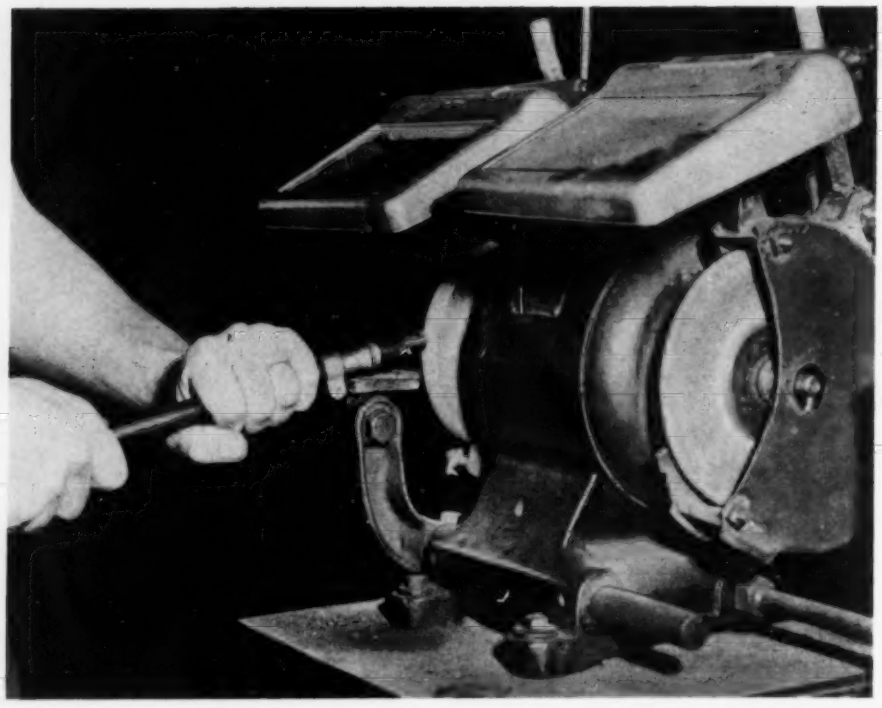

7. A TUBE DRESSER can handle irregular faces with ease. The tube grinds down continuously to expose fresh abrasive during the dressing.

Hand-Applied Dressers . . .

out frequent truing and dressing. Figure 1.

Truing and dressing are distinctly different operations performed for different results. Truing restores the original shape of the wheel's face, creates a new shape, and establishes the limits of accuracy of grind.

Dressing removes imbedded particles of metal from the surface of the wheel, as well as the top layer of dulled abrasive. This exposes sharp new grain for increased cutting action.

Dressing is sufficient to produce an open, fast cutting wheel. But, precision in grinding requires additional truing with a precision dresser or diamond in most instances.

Relatively accurate hand dressing can be done only with a properly tool rest. Locate the tool rest parallel to the face of the wheel in such a position that you can hook the feet of the dresser over the rest with the cutter set about ⅛-inch to ¼-inch from the face of the wheel, as in Figure 2.

Move the dresser across the face of the wheel with your left hand. Use your right hand to raise the end of the dresser handle to make the cutters contact the wheel. Reverse the position if you are left-handed.

If you see too many sparks fly, you will know that the cutters are being ground more than the wheel is being dressed. Press the dresser more firmly against the wheel so the cutters will revolve and really dig into the dull, loaded abrasive. You can tell that the dressing action is right when you remove a uniform amount of dulled grain straight across the face of the wheel in one smooth pass. There should be no grooves, low spots, or imbedded particles remaining.

Figure 3 shows the result of proper dressing. The face of the wheel is reasonably true, and sharp grains of abrasive are exposed for fast, accurate grinding.

Care of Cutters

But, this is only part of the story. As in most operations, proper truing and dressing depends as much on the proper care and use of good cutters as on the technique of the operator.

For instance, you should oil cutter pins and bushings at frequent intervals to prevent excessive wear and to insure proper rotation of the cutters. Replace cutter sets when they are worn down to the base of the teeth. Replace pins and bushings as soon as they show too much play in the cutters.

Never dress a wheel without a proper tool rest. Make certain that the dresser pins and bushings are not worn down too far for accurate operation of the cutter set. If you do too much dressing without lubrication, you may draw out the temper from the dresser pins and bushings from excessive heat.

Avoid dressing large diameter or wide faced wheels with small dressers designed for use on small wheels. You will only wear down the small cutters more rapidly and spend a lot of time replacing cutter sets.

Star shaped cutters, as in Figure 4, are for average dressing. Use the 1¼-inch, No. "O" size on wheels up to 10 inches in diameter or 2 inches across the face. Use the 1½-inch, No. 1 size for diameters up to 16 inches and faces up to 3 inches wide. Use 2⅜-inch, No. 2 cutters for wheels which are larger in diameter or in face width. These rules-of-thumb will cover 75% or more of all your wheel dressing requirements and will give you a sharp grinding face of reasonable

(continued page 58)

4. STAR TYPE DRESSERS will cover better than 75% of your needs if you choose the right sizes for your various wheels.

5. Corrugated cutters without teeth give a shearing action against the abrasive, leaving a relatively smooth finish to the wheel.

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The Semi-Automatic Internal Contour Grinder

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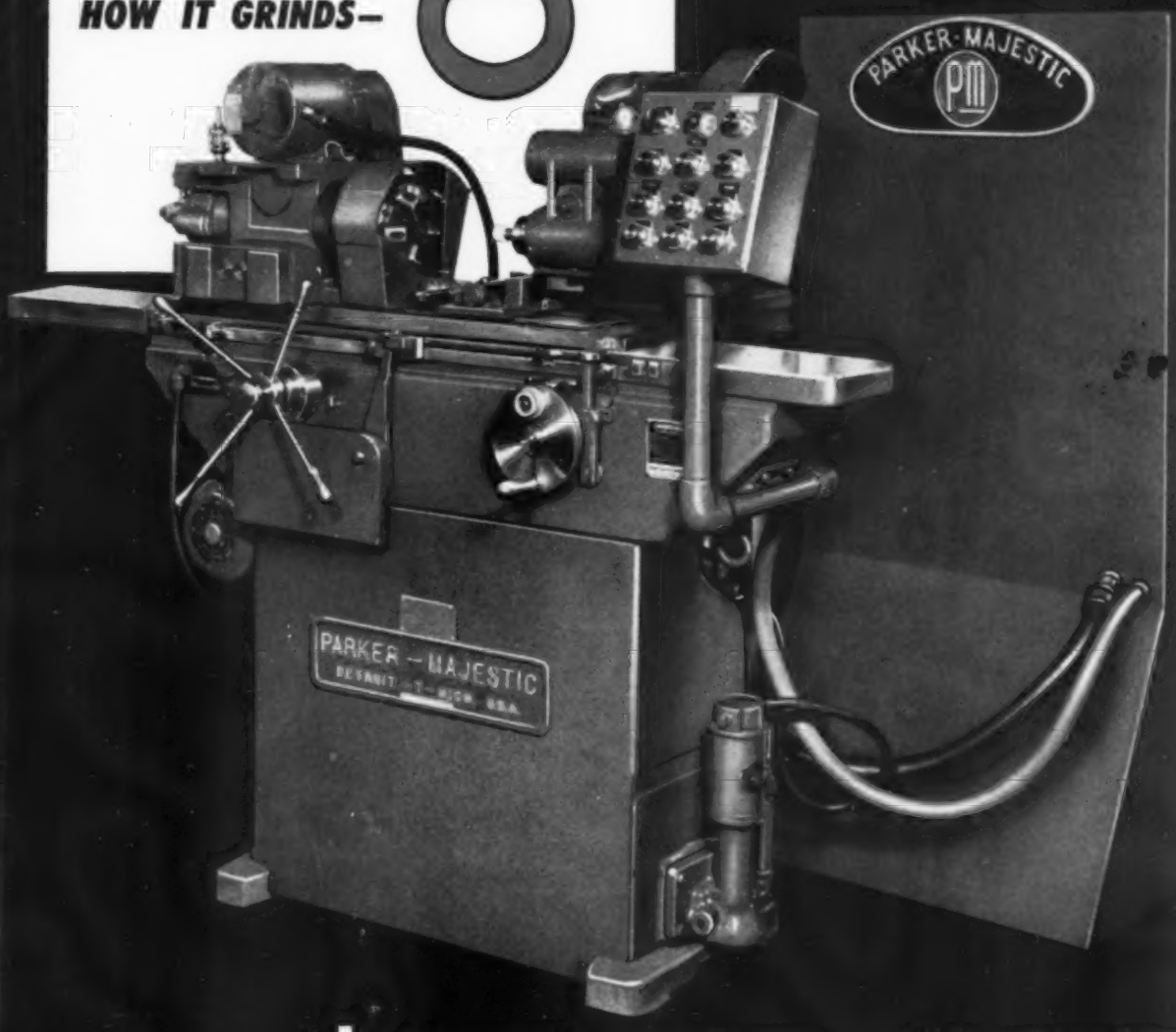

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3. Modest tool cost for change-over to different parts.
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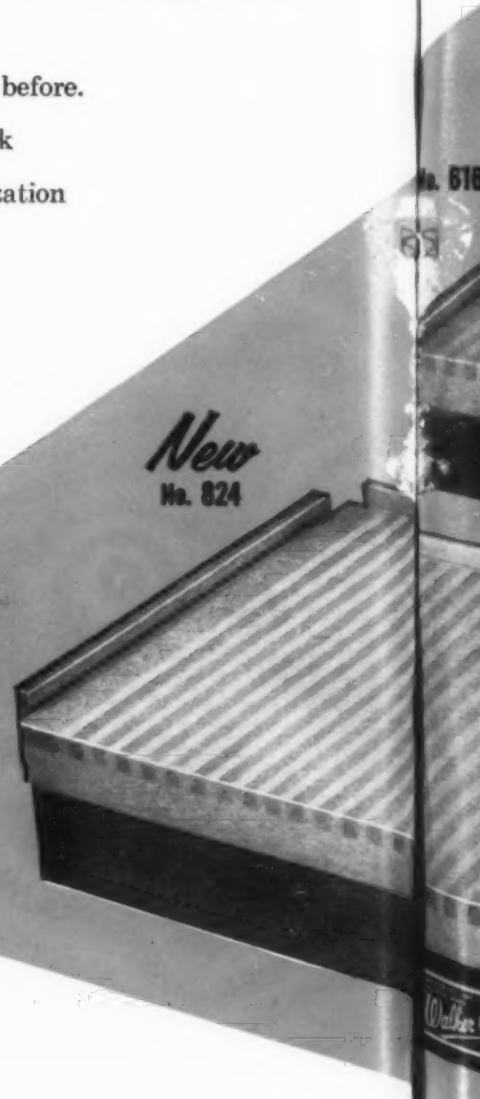
O. S. Walker, the originator of magnetic chucks, now offers a completely new, full line of chucks with the most permanent magnets ever produced — they're ceramic* — with many times the coercive force of alloy magnets. The face is *all* steel, with no soft insulating material. These chucks weigh only half as much as conventional permanent chucks, thus minimizing reciprocating table inertia.

Their low, low height gives more machine capacity than ever before.

Fine pole divisions give maximum holding on all types of work pieces. All magnetic fields are neutralized to prevent magnetization of machine table or ways. *Write for details.*

*Patent applied for



...perfect for milling too!

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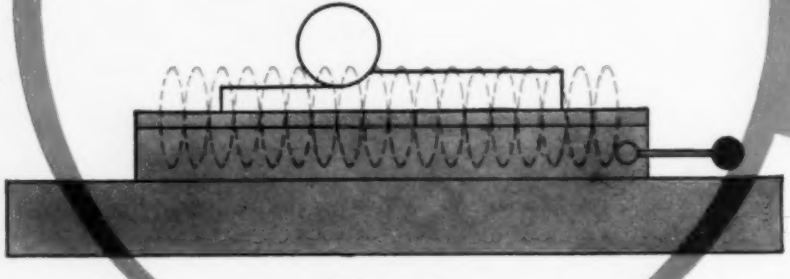

†O. S. Walker magnets are polarized horizontally (conventional construction has magnets polarized vertically).

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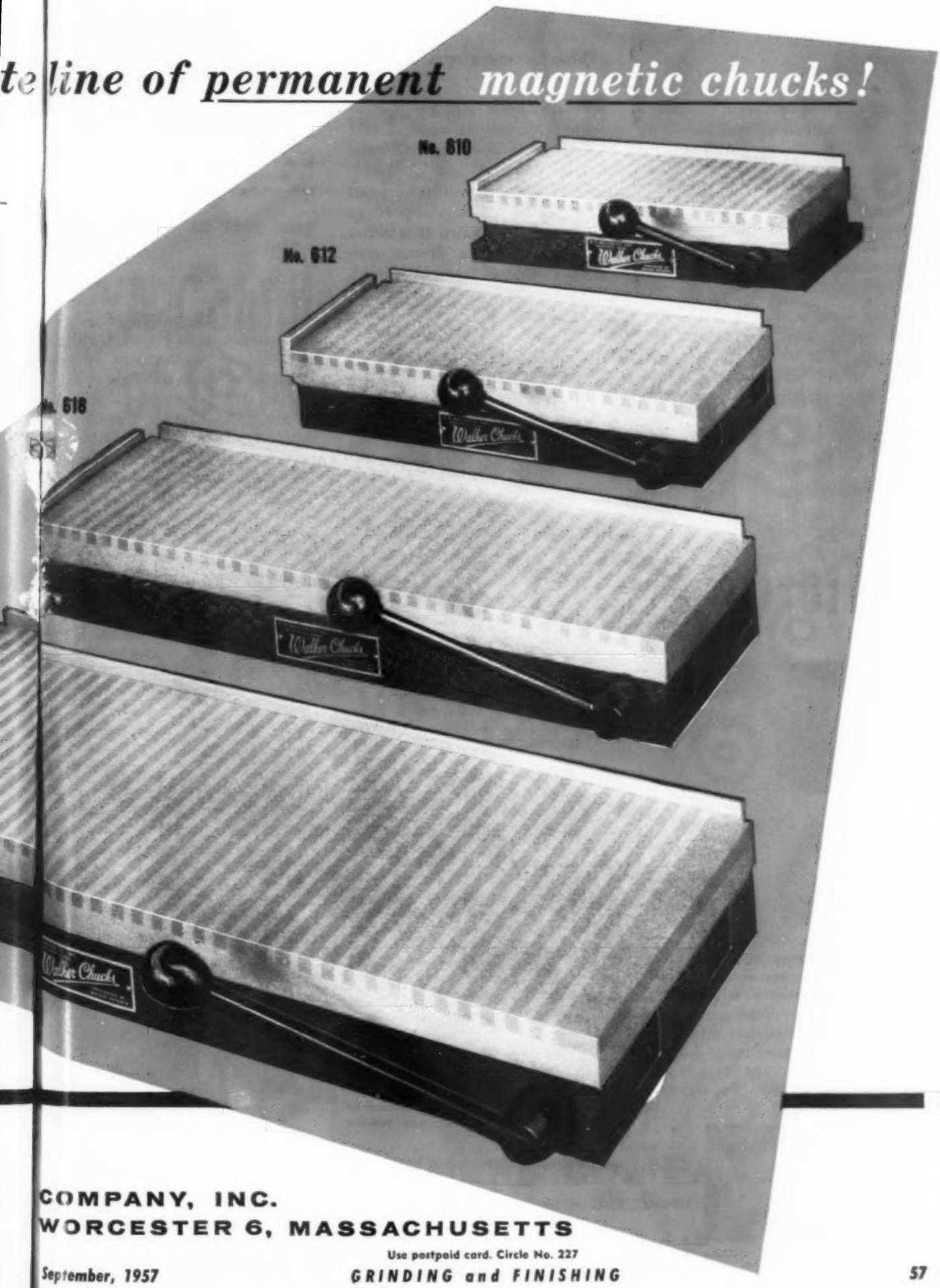
te line of permanent magnetic chucks!



COMPANY, INC.
WORCESTER 6, MASSACHUSETTS

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accuracy.

What about different kinds of wheels? High speed resin bonded and rubber wheels present a bearing problem to the ordinary dresser. Best performance on these wheels requires cutters mounted on ball bearings because of higher speeds involved. You can get even better results if the cutters are set at an angle to give both a shearing and picking action.

If you want a relatively smooth finish to the wheel, use corrugated cutters without teeth as in Figure 5. These cutters give a shearing action only.

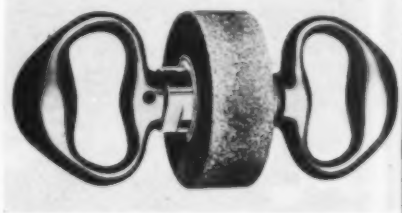
Special wheels call for special dressing. Narrow faced and odd shaped wheels, as in Figure 6, used for tool grinding, saw gumming and form grinding, will break down rapidly or lose their sharp edges with star type dressers. It is better to use a tube type dresser consisting of a steel tube filled with an abrasive mixture bonded under pressure and heat. Hold this dresser as in Figure 7. The tube wears down and exposes fresh abrasive grain until the mixture is consumed.

6. A FEW of the many different profiles on special wheels. These are ground best with a tube dresser.

Some grinders are not provided with tool rests. If this is true in your shop, you will need a hand held dresser as in Figure 8. Present this dresser to the face of your grinding wheel at an angle of about 15° to 30° to produce a shearing action. The dresser should have safety type handles to protect your hands. And, ball bearing construction will give you much longer service.

Everyone knows that a grinding wheel picks up particles from the work and soon becomes so loaded it is useless in a grinding operation. However, too many people overlook the fact that a few extra minutes time and a few cents cost spent on properly dressing and truing a wheel brings definite rewards in actual profits, to say nothing of the benefits to worker and machine. The increased production alone is worthy of your best attention. And, this is the only way you will get full value for the money you spend on quality grinding wheels.

It is well to remember that there are specialists in the field who will gladly advise you in the care of your wheels, and will supply you with the correct dressers and cutters for each dressing problem you encounter. • • •



8. GOOD HAND-HELD DRESSERS will have safety handles to protect your knuckles. Present the dressing wheel at a sharp angle to the grinding wheel.

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THE

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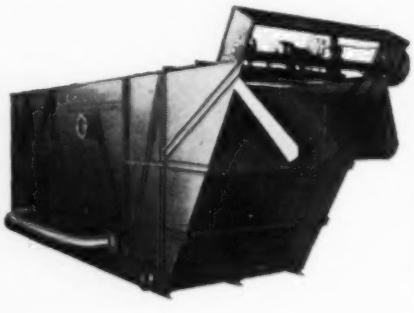

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REID PRECISION SURFACE GRINDERS REID PRECISION SURFACE GRINDERS REID PRECISION SURFACE GRINDERS REID PRECISION SURFACE GRINDERS REID PRECISION SURFACE GRINDERS REID PRECISION SURFACE GRINDERS

MODEL 618P
(large illustration)
with dust collector,
and (small illustration) with
wet grinding attachment.

A Complete Line of 618 and 824 Toolroom and Production Grinders

. . . and accessories

REID . . . the quality name in surface grinders! Choose from three different models in the 618 class; capacity 6″ wide, 18″ long, 17¼″ from spindle center to table. Accessories can be supplied for wet grinding, cool grinding, dust collecting, etc.

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MANUFACTURERS OF PRECISION GRINDERS AND PRODUCTION LATHES

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WRONG . . . Operator is risking at the very least a mashed or burned thumb, plus spoilage of the tool he thinks he is sharpening. Tool is not held firmly against work rest. Work rest is too far back from wheel. Opinions may differ as to guarding, but grinding face of wheel could be covered more. Man should have goggles or face shield.

GRINDING safely

by **Edmund Mottershead,** president Mottershead Associates, Chicago.

"Many a mickle makes a muckle" as Ben Franklin said in Poor Richard's Almanac many years ago. And many small details go into making up the total result of good grinding practice.

The experienced grinder operator will check his machine and check himself every time he starts a grinding job, no matter how small. That way, he never has the kind of accident which is caused by being in a hurry and being careless for a few moments.

Eye protection is a must, either goggles with full cups or a full face shield. If the grinder has a built-in glass shield, be sure it is not cracked or broken. Then the next step is to check the grinder. Be sure it isn't running. Most good stand grinders will run for some minutes after being shut off, the momentum of the wheel carrying it whirling around silently on its bearings.

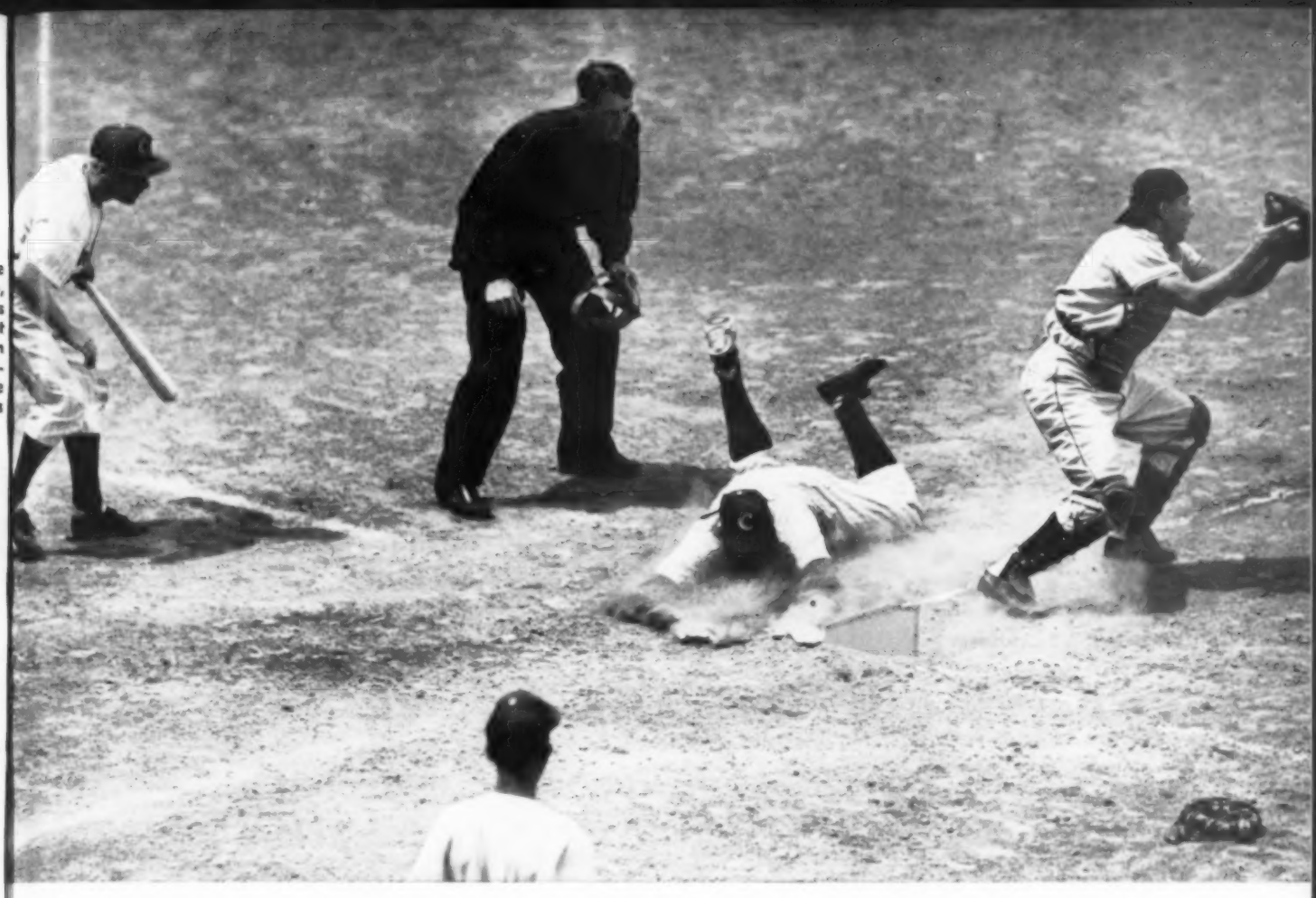
Move the work rest up to ⅛" from the grinding surface of the wheel, to prevent getting work or fingers caught between it and the wheel. Check wheel mounting for proper flanges and condition of flanges. See that the guard is in place.

Then turn the machine on and stand to one side for a moment until it has gotten under way and it is apparently running in good order. Put the work down firmly on the work rest and move it in gently at first with fingers well out of the way of the wheel.

And, don't forget to turn the wheel off when you're through! The next man might not notice it is running. • •

RIGHT . . . Same operator as above shows correct holding of work against work rest, with work rest moved up into position. Face shield gives him complete eye and face protection from flying particles. It's just as easy to do it the safe way . . . and gets better results.

RIGHT . . . Small objects like this little bushing often present nasty hand grinding problems simply because it is difficult to hold onto them and grind them properly. They must be held firmly against work rest, positioned closely against wheel. Face shield or other eye and nose protection is a must.



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Your CIMCOOL Distributor has valuable teamplay tips for you. He'll give you complete information on CIMCOOL Concentrate—and the entire family of CIMCOOL Cutting Fluids. Or contact us direct. We'll have one of our Cincinnati Milling-trained machinists call on you—without cost or obligation. Write, wire or telephone Sales Manager, Cincinnati Milling Products Division, Cincinnati 9, Ohio.

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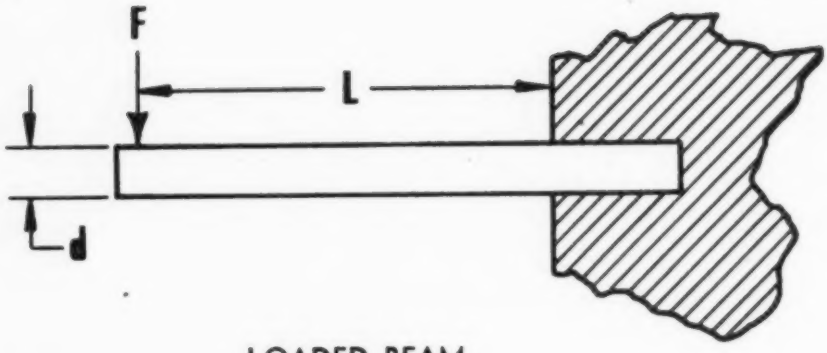
PRODUCTION-PROVED PRODUCTS OF THE CINCINNATI MILLING MACHINE CO.

Mandrel deflection which occurs in grinding long, small-diameter holes is intimately linked with the accuracy and economy of the operation. Here's a careful analysis of the deflection problem with useful tables.



LOADED BEAM

Mandrel Deflection : Important Factor in Hole Grinding

By **J. A. Yalmokas**
Estimator Planner
Gillette Safety Razor Co.

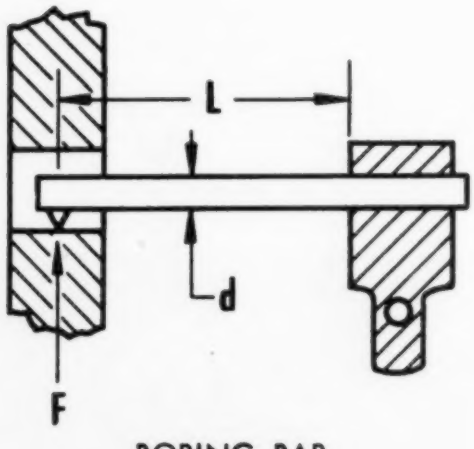
● Two of the most useful tools found in the machine shop are the single point boring tool and the grinding wheel spindle. Various forms of these tools are found throughout machine shops; as they are easily and readily adapted to producing accurate holes and for certain other operations.

It may seem strange that the two tools, that look so unlike each other, have one very important characteristic that is common to both tools. It is also important to note that this characteristic is a limiting factor in the use of the two tools. Each tool may be compared to a beam with one end rigidly fixed and a load at the other extreme end.

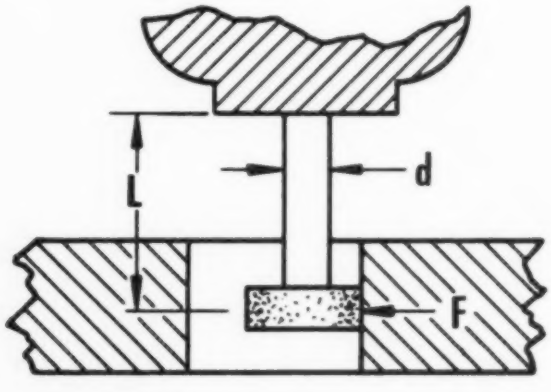
Comparing figures 1, 2, 3, it is readily seen that the two tools are exactly the same as beams loaded this way. Load "F" on the boring bar or grinding wheel plays a very important part in the functional qualities of each tool. This load is the force exerted on the tool by the cutting action of the tool against the material being cut. It varies from several hundred pounds in a lathe to a small fraction of a pound in a jig grinding machine.

Not realizing that this very important problem of diameter vs. length of diameter exists, many designers do not consider this problem when designing parts with accurate holes. In a great many cases, holes that are too long could easily be counterbored part way so that the length of the accurate part of the hole is materially shortened. A savings in time, tools, and manpower will be realized almost immediately. All of these factors add up to a considerable savings in time and money. The unusual high

(continued page 64)



BORING BAR



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It's Smarter to use . . .

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MODEL E HYDRAULIC
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The complete line of Arter Precision Grinding Machines is designed and engineered to provide remarkably accurate, micro-plane surface finishes. These uniformly consistent finishes result in a minimum of grinding operations . . . avoiding time-consuming extra finishing that makes production costs soar.

The superiority of Arter micro-plane finishes is a result of the grinding method. All grinding is done on the peripheral or outer edge of the wheel while the work is held on a rotating electro-magnetic chuck. The grinding wheel touches the work at only one spot resulting in an extremely fine, concentric finish. It's just the right touch for surfaces so uniform that, in many cases, they seal without lapping.

Accuracy and versatility are an inherent part of all Arter Machine Grinders. Each machine features rigid, vibration-free construction . . . hydraulic controls . . . variable stepless speeds for both chuck and wheel slide traverse . . . manual and automatic feeds . . . adjustable work tables for concave or convex grinding . . . convenient push-button control panel and compact design.

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Mandrel Deflection . . .

Table 1—Force in Pounds Required to Deflect Mandrel .0005 Inch

Length of Mandrel	Diameter of Mandrel (inches)							
	1/16	1/8	3/16	1/4	5/16	3/8	7/16	1/2
1 dia.	138.06	276.12	414.18	552.24	690.29	828.35	966.41	1,104.47
2 dia.	17.26	34.52	51.77	69.03	86.29	103.54	120.80	138.06
3 dia.	5.11	10.22	15.33	20.43	25.54	30.65	35.76	40.87
4 dia.	2.15	4.30	6.46	8.62	10.77	12.92	15.08	17.23
5 dia.	1.10	2.21	3.31	4.42	5.52	6.63	7.73	8.84
6 dia.	.64	1.27	1.91	2.54	3.18	3.81	4.45	5.08
7 dia.	.40	.80	1.20	1.60	2.00	2.40	2.80	3.20
8 dia.	.28	.55	.83	1.10	1.38	1.66	1.93	2.21

Forces given in table are computed from following formula (see text):

$$F = \frac{(3)(30 \times 10^6)(5 \times 10^{-4})(3.1416)}{64} \times \frac{d^4}{L^3}$$

Example: A ¼-inch diameter mandrel 1 inch (4 diameters) in length is deflected .0005-inch by a force of 8.62 pounds.

Table 2—Force in Pounds Required to Deflect Mandrel .0001 Inch

Length of Mandrel	Diameter of Mandrel (inches)							
	1/16	1/8	3/16	1/4	5/16	3/8	7/16	1/2
1 dia.	27.61	55.19	82.84	110.45	138.06	165.67	193.29	220.90
2 dia.	3.45	6.90	10.36	13.80	17.26	20.71	24.16	27.60
3 dia.	1.02	2.04	3.07	4.08	5.11	6.14	7.16	8.18
4 dia.	.43	.86	1.29	1.72	2.16	2.59	3.02	3.45
5 dia.	.22	.44	.66	.88	1.10	1.33	1.55	1.77
6 dia.	.13	.26	.39	.52	.64	.77	.90	1.02
7 dia.	.08	.16	.24	.32	.40	.48	.56	.64
8 dia.	.05	.11	.16	.22	.27	.32	.38	.43

Force computed from following formula (see text):

$$F = \frac{(3)(30 \times 10^6)(10^{-4})(3.1416)}{64} \times \frac{d^4}{L^3}$$

Example: A ⅛-inch mandrel extending 6 diameters (or ¾-inch) is deflected .0001-inch by a force of .26 pounds (only about 4 ounces).

quality of work being manufactured on jig grinders, with their extremely close tolerances, require that the problem of diameter of hole vs. length of hole must be considered when designing piece parts with ground holes.

The beam deflection formula, applied and analyzed regarding this problem, shows amazing results. A study of these results should give a real and thorough understanding of one of the problems of machining and grinding, particularly in the jig boring and jig grinding fields. This formula is:

$$D = \frac{FL^3}{3E\left[\frac{\pi\ d^4}{64}\right]}, \text{ where}$$

D=Deflection in inches
F=Force in pounds
L=Length of force arm in inches
d=Diameter of bar in inches
E=Modulus of elasticity of material used for bar.
(Steel = 30,000,000)

Out-of-roundness, tapered holes, and bell-mouth holes are all direct results of boring bars not supported properly, and as this is a major problem of the jig grinder, our study is chiefly concerned with the jig grinder and grinding in general.

Converting the formula and solving for "F", it becomes a fairly simple mathematical problem to find any force necessary for any given deflection. Holding the deflection as a constant in the problem and computing "F" for various lengths; tables can easily be made and compared.

The most common tolerance for jig grinder work is .0005-inch, which is a fairly large tolerance. Using this tolerance as the constant deflection, the beam formula becomes:

[1] $$F = \frac{3\ \pi\ D\ E\ d^4}{64L^3}$$

[2] $$F = \frac{(3)(3.1416)(.0005)(30{,}000{,}000)\ d^4}{64L^3}$$

(continued next page)

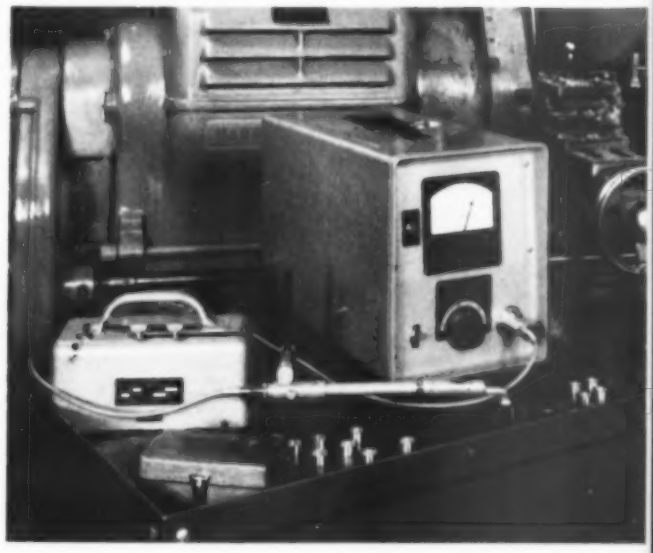
PRODUCTION INSTRUMENTS FOR SURFACE CONTROL

More and more companies are obtaining better quality of products and better production economy through greater knowledge of the surfaces that they produce.

The four production instruments shown on these pages provide that knowledge, through numerical measurement of important surface characteristics. Thus, these instruments permit the *specification* and close *control* that are essential to the above-named benefits.

1. For measuring surface roughness . . .

THE PROFILOMETER®

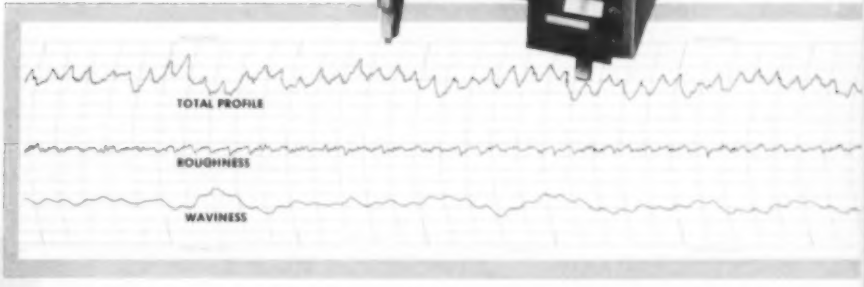


THE PROFILOMETER measures the roughness of practically *all* machined and finished surfaces — internal and external — in standard microinch units. It gives *consistent, accurate readings* for *any* surface from polished glass to rough-machined forgings. It is fast and simple to operate — can be used wherever desired — and is standard equipment in *thousands* of production and inspection departments, throughout the world.

BULLETIN LT14 gives details, and describes cost-saving applications.

2. For obtaining surface profile records . . .

THE PROFICORDER®



Profile records of the same surface (¼ actual size) showing total profile, roughness profile and waviness profile.

THE PROFICORDER provides a chart record of the magnified profile of internal and external machined and finished surfaces. It records (1) the total profile, including roughness and widely-spaced irregularities, (2) waviness, bows, steps, etc., with roughness omitted, or (3) roughness irregularities alone, as desired — with a wide choice of magnifications. The charts show the *height* and *spacing* of the irregularities, and open up new possibilities in production set-up, inspection and control, and in research and development work.

BULLETIN LT24 gives details and specifications.

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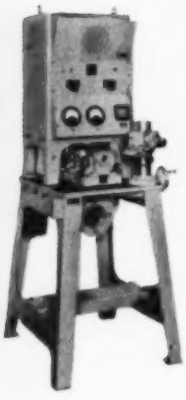
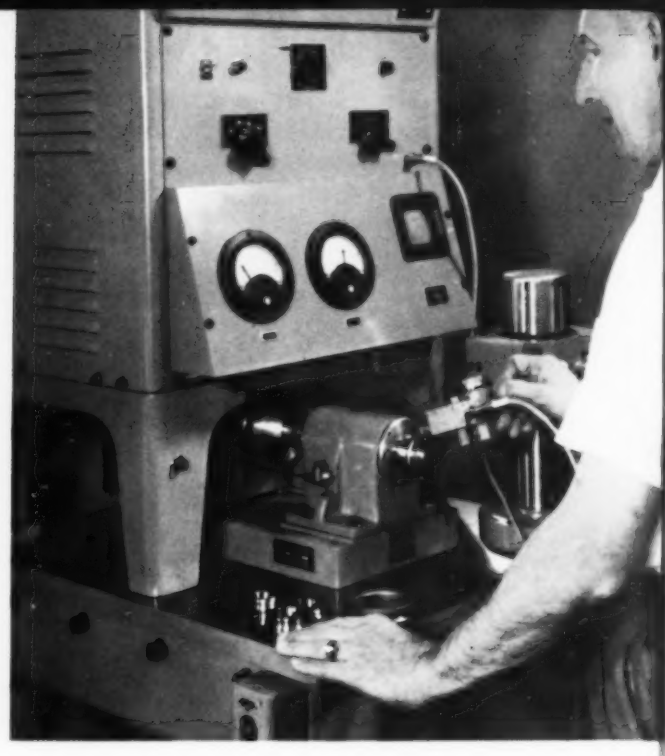
3. *For measuring waviness around surfaces of rotation . . .*

THE WAVOMETER®



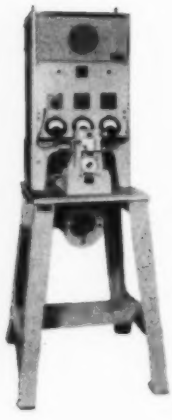
THE WAVOMETER measures the waviness around internal and external surfaces of rotation on a production basis. This instrument (1) gives meter readings of the average height of the waves in two wave-bands, in microinches; (2) shows on an oscilloscope the general shape and spacing of the waves in either wave-band; and (3) permits nicks, scratches and deviations in quality to be detected by means of a loudspeaker.



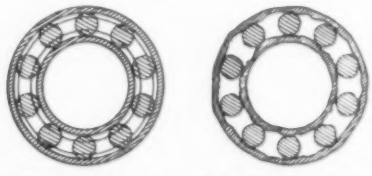
BULLETIN LT10 explains the causes and nature of waviness, and describes the Wavometer in detail.

4. *For measuring the over-all quality of assembled ball bearings . . .*

THE ANDEROMETER®



WITH ALL BALL BEARINGS, the balls and raceways have surface irregularities of widely-varied height and spacing. When a bearing is in use, these irregularities of contour produce a complex cam action that results in noise and vibration.



These drawings show an *ideal* ball bearing (left) with geometrically-perfect balls and races, and an *actual* bearing with surface irregularities greatly enlarged radially. These irregularities cause radial movement when bearing is running.

The Anderometer *measures* this characteristic, in units called *Anderons,* on a meter for each of three measurement bands, while the bearing is running under thrust load. Thus, the Anderometer enables ball bearing users to write definite *numerical specifications* for bearing quality. It also provides for *checking* bearings against those specifications by a *dependable, unbiassed instrument,* in production and receiving inspection.

BULLETIN LT11 gives details. An Anderometer technical bulletin is also available.

WRITE FOR FREE LITERATURE on all of these instruments that are of interest to you.

Profilometer, Proficorder, Wavometer and Anderometer are registered trade-marks.

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THE MICROMETRICAL MANUFACTURING COMPANY

345 S. MAIN ST., ANN ARBOR, MICHIGAN **CABLE: MICROMET**

Form LT25 — 4-57-100

Printed in U.S.A.

MANDREL DEFLECTION

$$[3] \quad F = \frac{(3)(3.1416)(5\times10^{-4})(30\times10^{6})}{64} \times \frac{d^4}{L^3}$$

combining and solving:

$$[4] \quad F = 2208.9 \frac{d^4}{L^3}$$

Again repeating with a tolerance of .0001-inch as a constant deflection, tables are charted and forces in pounds of each can be compared. See Tables 1 and 2.

Upon careful examination of formula No. 4, it is very evident that the force "F" varies directly as the fourth power of the diameter of the bar and inversely as the cube of the length. With very small holes (fractional sizes) the fourth power of the diameter becomes a very small number; giving a small number as a resulting answer. And dividing this resulting number by the cube of a relatively large number (L^3) results in even a smaller number.

Comparison of the results tabulated in the two charts shows that only a few ounces will deflect the mandrel of the smaller grinding wheels. As a general rule, most tool companies (Moore Special Tool Co., etc.) recommend that the hole should not be any longer than 6 hole diameters long. In some cases, this is even too long for it becomes necessary to spend a large amount of money and time to produce these holes. In quite a few cases, these very accurate holes are not really necessary to the functioning of the piece part.

In the interest of good machine shop practice, it now becomes necessary for draftsmen and designers to pay particular attention to this problem. • • •

New Reprint . . .
"Lapping with Diamonds," from the June, 1957, issue of GRINDING and FINISHING, is now available in reprint form, sent free of charge. 222 E. Willow Ave., Wheaton, Ill.

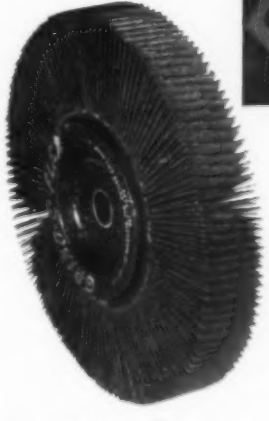
Ever see a ROUND WHEEL fit into a SQUARE CORNER ?

GRIND-O-FLEX DOES IT

Unretouched photo

Here's a 3-inch diameter Grind-O-Flex wheel smoothing and blending draw marks and welds on a tubular frame. Note how it shapes itself to the contour.

and for ROUGH JOBS...



Grind-O-Flex comes in big diameters too—in fine or coarse grits—to blend welds, smooth casting flash, polish rough surfaces. Wheels form themselves to fit the job. No danger of "digging" into stock. There is a grit grade to fit your job, polish or grind.

Beautiful-finish-wise, cost-wise and time-saving-wise, nothing can touch GRIND-O-FLEX.

Our Engineering Staff can recommend the wheel for your job, and a supply source near you. Write us.

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LAPPING AND GRINDING COMPOUND

THE first made-up, ready-to-use lapping and grinding compound in history appeared in 1903. It was the first patented compound, the first made with a melting point high enough to assure total suspension of the grit under the heat produced by power lapping. It was an indispensable tool for the mechanic and the manufacturer in the early years of the century. It has been the standard of industry, the world over, ever since. Everybody recognizes the green Clover can.

Clover Lapping and Grinding Compound is still best for gear lapping, to remove feather edges of machined components, to lap in parts that must fit perfectly. General industrial use includes shaft and cylinder lapping of all kinds of pumps, lapping in high-pressure liquid valves, diesel engine valves and parts, fuel-injection valves, and many other uses.

Clover Lapping and Grinding Compound comes in a full range of standard grits of Silicon Carbide. For plants or shops that prefer it, Clover makes a water-soluble compound as well as the regular grease mixed. On special order, almost any combination of high- or low-viscosity binder and any grit of Aluminum Oxide, Norbide, or Silicon Carbide can be furnished.

Clover is prepared to make compounds to suit your particular problems. Just write or telephone us.

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NORWALK, CONN., U. S. A.

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Lapping and Grinding Compounds

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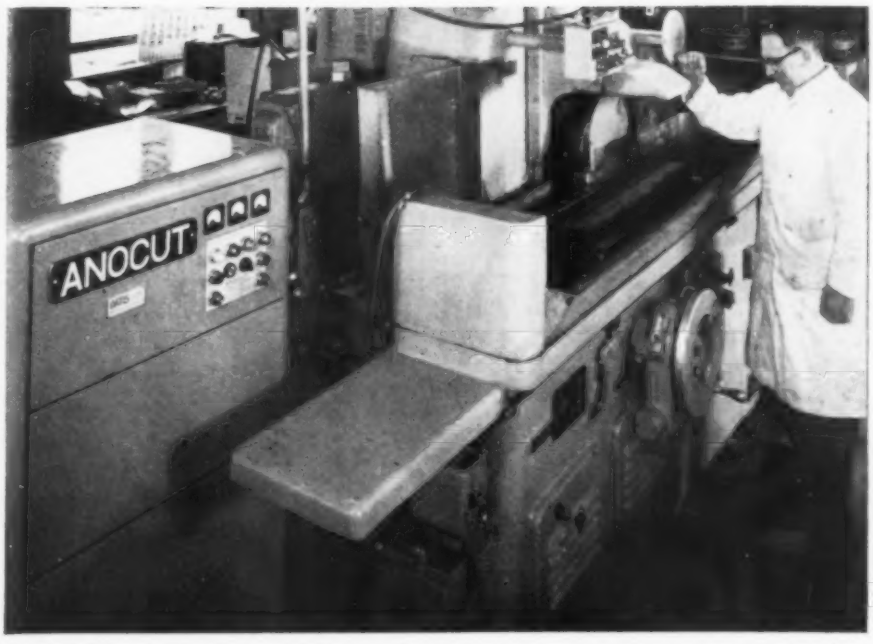


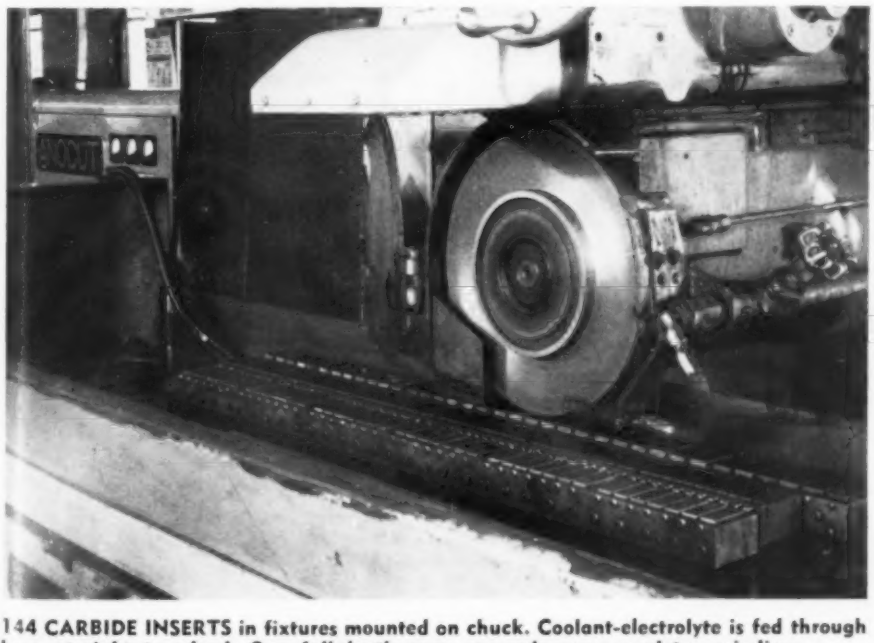
THOMPSON SURFACE GRINDER equipped with an Anocut power unit. Grinding wheel is rendered negative, workpieces positive. A coolant-electrolyte completes the circuit. Through electrolysis, abrasive consumption is reduced by 80-90%.

Saves 90% in Diamond Wheel Costs

Electrolytic unit on standard No. 3 surface grinder enables carbide grinding service to rough grind many carbide blanks at a time, with heavy stock removal.

● Cooperative Carbide Grinding Co., Inc., Anderson, Indiana, is realizing great economies in diamond wheel use and savings in operation time by using an elec-

(continued next page)



144 CARBIDE INSERTS in fixtures mounted on chuck. Coolant-electrolyte is fed through hose at right to wheel. One full-depth pass on each row completes grinding.

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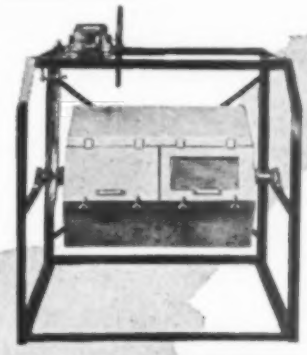

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NEW TORIT DIAMOND DUST COLLECTOR SAVES YOU UP TO 30% OF CARAT USAGE; COSTS ONLY $178.50!

Dust from these diamond wheels . . .

was recovered by this Torit Diamond Dust Collector . . .

at the rate of (50.5) carats in 14 days.

exclusive new centrifugal design simplifies recovery, serves all diamond grinding operations

Actually pays for itself in days. In an on-the-job test of this new TORIT equipment, the initial investment was returned in just 21 operating days. The test was conducted by a leading automobile manufacturer under regular operating conditions. Recovery averaged 30% of the carats originally contained in the diamond grinding wheels. You actually get a cash return of $1.00 for every $10.00 invested in diamond grinding wheels.

For all diamond grinding operations. This new TORIT Collector provides the same outstanding performance in all types of grinding operations—mist, wick or dry. Its design and operational simplicity also mean virtually maintenance-free service. Its tough construction assures long, long life.

Installs anywhere. TORIT'S new Diamond Dust Collector can be used alone or in conjunction with central exhaust systems or unit dust collectors. It weighs only 65 lbs. and requires only 14" x 22" floor space. Its centrifugal separating action uses no filters or sloppy, inflammable oil baths. Service is quickly and conveniently performed by simply unscrewing the unit's top for removal and emptying of the clear plastic container.

FREE details and full specifications on request. Here's your chance to really save on your diamond usage. Write today for full information on this important new diamond grinding development.

TORIT MANUFACTURING COMPANY Walnut & Exchange Sts.,

Dept. 514, St. Paul, Minnesota

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Saves 90% in Diamond Wheel Costs . . .

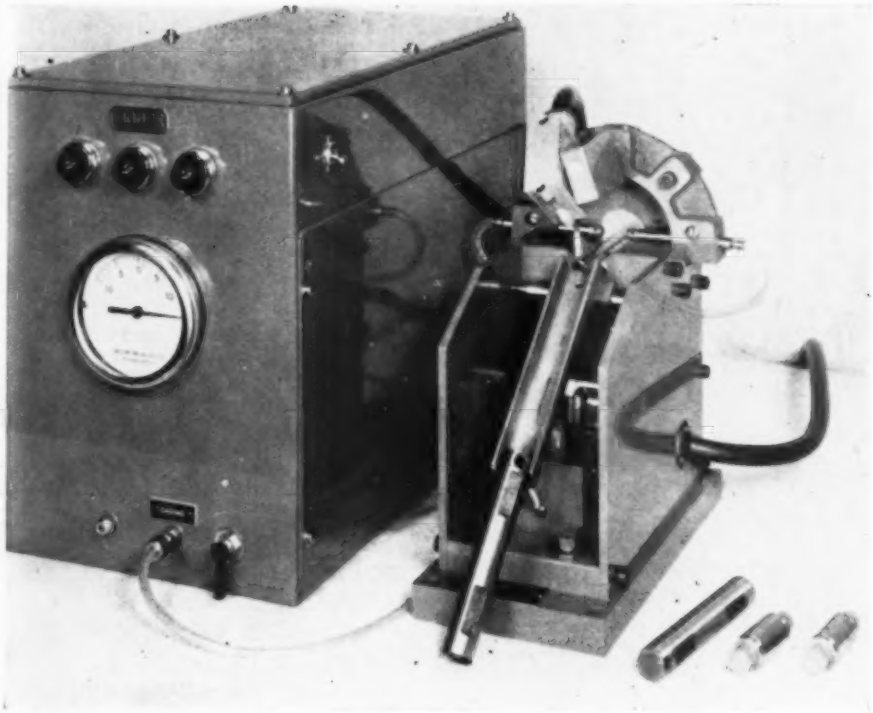
trolytic grinding attachment on a No. 3 surface grinder for the rough or preliminary grinding of carbide tool inserts. One pass under the wheel at a traverse rate of 6 inches per minute and a downfeed of .010 to .015-inch does the job, with a reduction in diamond wheel consumption of 80 to 90%.

The carbides being ground here are full length inserts (types TB-16, 12, 8) as well as the smaller throwaway type. Tool fixtures for mounting the workpiece are of the same height so that all three sizes of the larger inserts may be ground in one pass on the Thompson No. 3B Surface Grinder equipped with an Anocut automatic, electronically controlled power supply unit for electrolytic grinding.

The wheel on this surface grinder, run at 1725 R.P.M., is a 1" x 12", 100 concentration, 120 grit metal bond wheel which is negatively charged in the electrolytic circuit, the workpieces being charged positively. The coolant-electrolyte completes the electrolytic circuit. On standard carbide insert grinding, one cubic inch of carbide is removed for each .0001 inch of wheel wear. The wheel in the photographs has already been in use for over four months. A 1-inch wide grinding pass is taken.

Prior to the adoption of the electrolytic equipment, Cooperative was using conventional diamond grinding wheels. Though effective, the work proved to be costly; diamond wheel consumption expense mounted rapidly due to excessive wheel wear. However, when the electronic-electrolytic equipment was installed evidence of economies soon appeared.

Actual grinding time has been significantly reduced, for the electrolytic process, by deplating the metal, reduces the requirement of abrasive action by as much as 90%. The grind is completed in one pass with only a fraction of the wheel-to-work resistance found in ordinary grinding operations. 144 carbide inserts are mounted on the chuck for simultaneous grinding.



IN THIS ADAPTATION of the Moore Products air gaging cabinet, the unit provides feedback control of a centerless grinder and as an auxiliary function operates and programs a segregator. Parts come out of the grinder and are gaged by the head, then are guided into the proper bin by the tilting chute, right foreground.

Air Gages for Grinder Control: Some Recent Applications

● Originally developed for the requirements of automatic post-process gaging of thrufeed centerless grinder output, an air gaging unit manufactured by Moore Products Company is now being successfully applied to a number of other interesting grinder control gaging operations.

The basic gaging unit is known as the Model 871 Cabinet, and was introduced by Moore in 1956. It is of the pneumatic-electric type, and can be fitted with a number of stock gaging contacts for mounting on the grinder workrest.

The usual installation of this type of unit consists of (a) a gaging head mounted adjacent to the output side of the wheels and through which the work moves, impelled by the regulating wheel, and (b) a cabinet (Model 871) which receives the pneumatic gaging pressure signal from the head. The gaging pressure, by means of pneumatic-electric relays, operates a series of electrical contacts which in turn operate signal lights mounted on the front of the cabinet. These contacts are also available for use as part of a feedback circuit to correct and/or shut down the grinder when the workpiece approaches tolerance limits. Ordinarily in this type of installation, the head measures the size change trend only. The parts slide through the head on a "vee" block which is part of the head and their size is sensed by an overhanging pivoted blade. Motion of this blade caused by workpiece size changes operates a reed system to cause the equivalent clearance change at the gaging nozzle. See the drawing of this type of adjustable trend gage.

In contrast to this usual type of installation for centerless grinder control, several outstanding applications of these basic gaging components have been made recently

(continued next page)

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RESINOID DIAMOND WHEELS

The *Best* Diamond wheel ever developed

- U.S. DIAMOND'S PROVEN REVOLUTIONARY "PRESURELOK"® Process increases Diamond holding efficiency by 300%.
- Positively no danger of heating or cracking carbide with the most rapid stock removal.
- Use dry or with coolants.
- They are consistently super-finishing, out-producing, under-costing any other Diamond wheel ever produced . . . and they are always readily available.
- If you have used them, you know they are the best! . . . If you haven't, let us show you!

US

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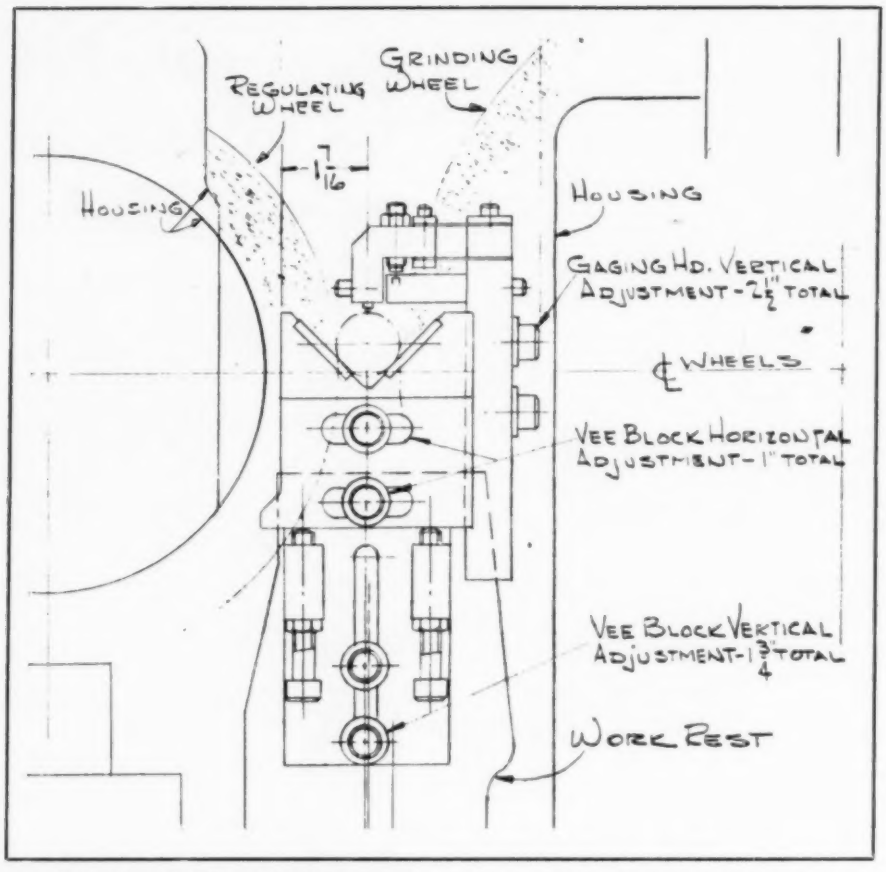

STANDARD TREND GAGE UNIT is used in most centerless grinder installations where thrufeed machine is controlled by gaging unit. Maximum speed of this type control is 24,000 pieces/hour.

Air Gages for Grinder Control . . .

in which size control is accomplished in a different manner. They include:

• *Infeed Grinder Control* (in-process)—The shoes of a Microcentric grinder were used as gaging reference surfaces and a Moore air-gaging capsule served as a gaging pickup. The standard Model 871 gaging control cabinet was connected to the gaging pickup. This unit provides four cycle control switching points, including "cycle start," "fast feed," "slow feed," and "final size."

• *Ammunition Gaging*—The Model 871 and a special Moore pickup were incorporated into an indexing machine which assembled primers for 20 mm cartridge cases. The equipment gaged the primer bridge thickness and provided segregation signals.

• *Cascade Control*—The basic Model 871 cabinet served in this

HANCHETT
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for HOT or COLD CIRCULAR SAWS
Solid or Inserted Tooth Types

HEAVY DUTY – BALANCED DESIGN

Straight Line Grinding Wheel Feed Action – Smooth and Accurate

Wheel Head Adjustable for any Saw Tooth Angle Desired (Cam Action)

- Grinding wheel speed is adjustable for wheel wear
- 100% anti friction bearings for smooth, trouble-free operation
- Accurate—simple stroke adjustment for both feed and lift cams
- Rugged construction for hard, heavy duty performance
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- Grinding wheel head motor—two h.p. (belted type)
- Capacity—24" to 72" diameter saws (larger when required)
- Available—other sizes and types of machines to meet all saw requirements

MODEL 572

HANCHETT MANUFACTURING COMPANY
World's Largest Manufacturers of Saw Sharpening and Knife Grinding Machinery

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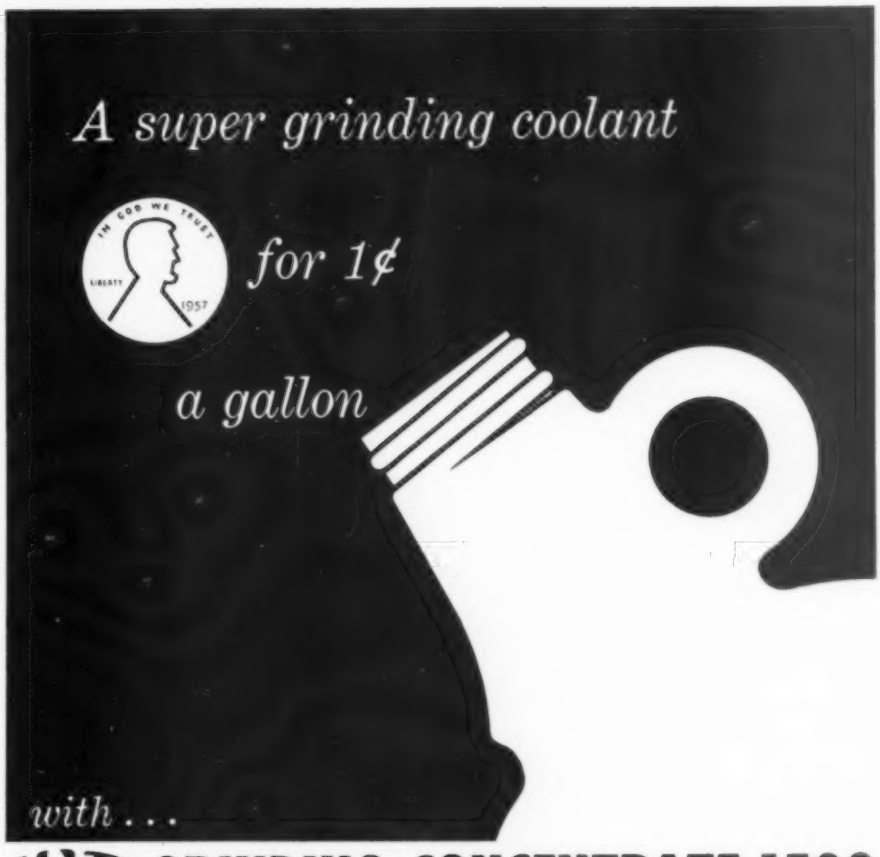
case as the in-process portion of a cascade grinder control system, to give completely automatic "closed loop" machine tool control.

• *Vertical Grinder Control* (in-process)—Here the basic gaging unit was applied to a Frauenthal vertical spindle machine which was grinding the hub of a transmission housing. Moore gaging capsules mounted in a pivoted arm served as size pickups. An interesting detail of the installation was that the gaging cabinet signals were fed back to a Westinghouse Cypak control circuit.

• *Workpiece Segregation*—The photo accompanying this article shows another successful application of the Model 871 air gaging cabinet. Here, in addition to providing its primary function of giving feedback control to a centerless grinder, it also actuates and programs a segregator for separation of parts into size categories. Because the workpiece OD is interrupted by flats and holes, a standard "snap switch" timing gage head was chosen. Here each individual workpiece is separately measured and an electrical signal based on that measurement is created. The leading edge of each workpiece operates a snap-switch so that the gaging signal is forthcoming at the proper instant. This instant occurs when the measuring nozzles have been impinged upon an uninterrupted portion of the work OD for sufficient time to permit full gaging pressure buildup. The maximum speed of this type of unit is 7000 per hour.

For this installation, the head is mounted on a special fixture which houses a set of work piece guide rails and a segregating mechanism. The work, impelled by the grinder regulating wheel, passes through the gaging head and slides down the segregating chute. The angle assumed by the pivoted chute guides the workpiece into the proper classification bin. The chute is positioned by an air cylinder which responds to the particular size class of each workpiece.

Since the major components of this special unit—the cabinet and the gaging head—are "off-the-shelf" building blocks, great savings in price and delivery can be gained. • • •



W+B GRINDING CONCENTRATE 1500

Normal dilution for this entirely different type of coolant is from 150 to 200 parts of water to 1 part W & B Grinding Concentrate 1500. And since W & B 1500 is used in extreme dilutions, one 55-gallon drum provides up to 11,000 gallons of grinding coolant — at a cost of about 1¢ a gallon.

Foamless as water, W & B 1500 gives excellent rust protection and provides a transparent mix that really keeps wheels open. Grinding is keener . . . machines stay cleaner. Chips settle almost instantly. Get complete information on this outstanding grinding concentrate. Fill out and return attached coupon.

W & B Grinding Concentrate 1500 is being used by many of the country's largest manufacturers.

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THE WHITE & BAGLEY CO.

Worcester, Massachusetts • Detroit, Michigan

Originators of Grinding Lubricants

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Please send me complete information on W & B Grinding Concentrate 1500 — and the list of large users.

Name ..... Title .....

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City ..... Zone ..... State .....

☐ My plant has a tricky grinding problem on which we'd like advice. I've attached a letter describing it in detail. I understand that you offer this service without obligation.

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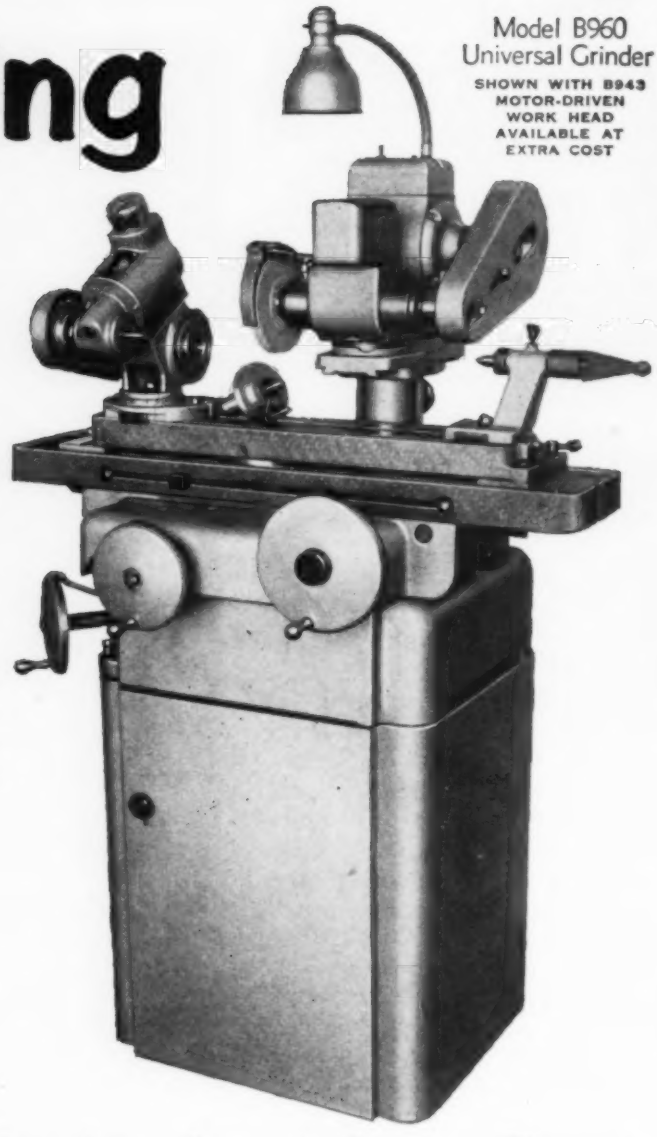
Announcing

the New!

B900 Series K. O. LEE GRINDERS

Model B960
Universal Grinder
SHOWN WITH B943 MOTOR-DRIVEN WORK HEAD AVAILABLE AT EXTRA COST



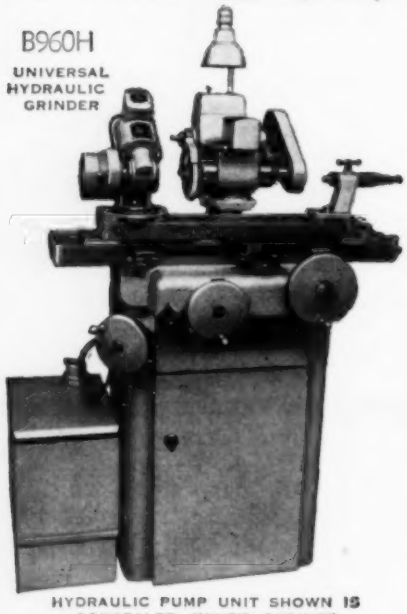
The new Lee grinders have improved accuracy standards, greater capacities, 25% heavier construction, V-type Saddle, larger table ways, improved lubrication system giving longer life, and many refinements for easy operation. New engineering features simplify and minimize time in making setups for almost every operation.

Available Models

B900 Tool & Cutter Grinder
B900X Basic Tool Grinder
B960 Universal Tool Grinder

K. O. Lee Company Offers a Complete Line of Grinder Fixtures

B960H
UNIVERSAL HYDRAULIC GRINDER



HYDRAULIC PUMP UNIT SHOWN IS CONCEALED INSIDE CABINET

The K. O. Lee Company makes available a large selection of fixtures adaptable to the B900 series grinders. Partial list includes: Motor Driven Work Heads, Tap Grinding Fixtures, Tilt Table Attachments for forming and sharpening cemented carbide tools, High Speed Grinding Attachment, Radial Grinding Fixtures, Universal Work Holding Fixtures, Sensitive Work Heads, Diamond Dressers, and Cutter and Hob Grinding Arbors.

HYDRAULIC POWER UNIT

For Table Traverse Available on all

LEE B900 SERIES GRINDERS

Hydraulic Pump Unit Shown Is Concealed In Base Cabinet

CLIP AD TO LETTERHEAD
AND SEND FOR COMPLETE LITERATURE

K. O. LEE COMPANY, ABERDEEN, SO. DAKOTA

"The new B900 series K. O. Lee grinders will be on display at the National Metal Exposition, Chicago, Booth 1397, November 4-8, 1957."

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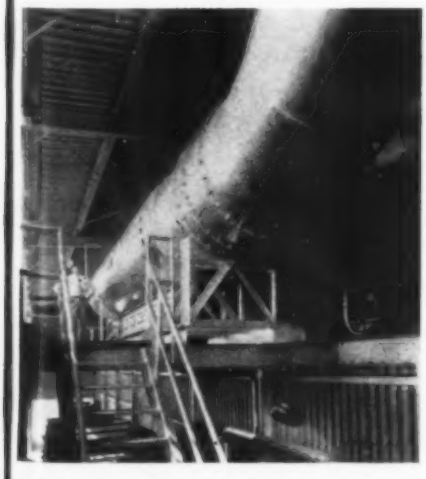
RAIL MOUNTED SNAGGING grinders replace old-style swing-frame grinders in Allegheny-Ludlum's new Brackenridge plant. More effective control of grinders gives better results on stainless billets.

Allegheny Ludlum Sets Up for Stainless Snagging

• At Allegheny Ludlum Steel Corporation's sprawling Brackenridge plant near Pittsburgh, a new grinding operation has been set up to remove surface imperfections on slabs of stainless steel. Outstanding features of the new installation are the semiautomatic billet grinders and the high-capacity dust collectors of a recent design.



OVERHEAD ductwork for the Brackenridge snagging operation includes four dust collectors of 48,000 cfm capacity each.

The new Number 10 grinding department, as it is designated, has seven new hydraulic-electric billet grinders which move on rails up and down the length of the steel slab as the electrically-powered grinding wheels snag the stainless billets in preparation for further heating and rolling. Hydraulic pressure maintains wheel contact with the slab, as the operator sits and manipulates the power controls of the grinder.

The new semiautomatic machines are much faster and more efficient than their swing-frame grinder predecessors which were entirely manually operated. Because of steadier pressure and more effective control made possible by the new grinders, surface grinding is more uniform, resulting in a smoother, more uniform surface on the finished billet.

Each grinder of the Bracken-

(continued on next page)

your missing link

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precision quality lapping machines

for every lapping requirement... both flat and cylindrical

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illustrated: Spitfire Gyro-Matic "21" automatic flat lapping machine

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2931 N. Pulaski Rd., Chicago 41, Ill.

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Whether you need a single, standard polishing head or a specially engineered, fully automatic production line with all the trimmings, Murray-Way can do the job better, more reliably, for greater operating efficiency.
You are invited to consult our engineering staff about your finishing problems.
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P. O. BOX 180, MAPLE ROAD EAST BIRMINGHAM, MICH.
Polishing, Buffing, Grinding, Filtering Equipment
that automatically cuts your costs.
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SEVEN SEMI-AUTOMATIC grinders of the Brackenridge plant give installation high production capacity.

Allegheny Ludlum . . .

ridge installation faces a booth into which the sparks and fine dust from the slab surfaces are sprayed by the grinding wheel. The dust is pulled into a hood and connecting duct work by four new-type Joy Microdyne dust collectors, each with 48,000 cfm capacity.

The four collectors are doing a job which probably would have been impossible for previous types of dust control equipment—moving the dust from all seven grinders without installing a unit for each of the grinders. Savings were thus realized in space and in installation expense.

A single settling tank located at the end of the grinding department removes the slurry accumulated from all four dust collecting units, as opposed to the more usual system of individual boxes for each collector.

The Joy collecting units are constructed with type 316 stainless steel throughout. This material is said to be able to withstand the corrosive and erosive action of the grinding wheel abrasive particles and high alloy steel dust mixed with water in the collector. Connections for water in the Brackenridge installation were made from the building's normal water supply.

• • •

Grinding and Finishing

Free Literature

Use the postpaid card opposite page 80 to receive your copy of any of the literature listed on these pages. Just circle the proper number on the card and mail it. We'll do the rest.

Mounted Wheels

Catalog bulletin Form ESA-67 describes complete line of abrasive mounted wheels. All sizes and shapes in the A and B series are illustrated in actual size with dimensions indicated, and typical shapes of the W series with complete listing are included. Also shown are the new standard suffix designations for mandrel projections and diameters recently adopted.

Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia, Pa.

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Cut-off Wheels

Abrasive cut-off wheels for all kinds of applications and depressed center abrasive wheels for use with right angle grinders are described in Bulletin GC-57. Recommendations are listed for applications ranging from the fine finishing of stainless steel to the cutting and cleaning of tough alloy castings. Different types of wheel construction are illustrated, including wheels reinforced with fabric and incorporating new "waffle" sides.

Electro Refractories & Abrasives Corp., 344 Delaware Ave., Buffalo 2, N.Y.

Use postpaid card. Circle No. 2

Surface Grinders

Hydrabrasive surface grinders are available in three sizes: 8″ x 24″, 12″ x 18″, 12″ x 24″. All models have 12″ capacity to table under a 12″ wheel, but can be built with 18″ under the wheel. There is 3-5/16″ clearance under the head for grinding between guide pins. For effortless travel up and down the column, the head, spindle and motor are balanced on the elevating screw and ways.

Folder from Abrasive Machine Tool Co., East Providence, R.I.

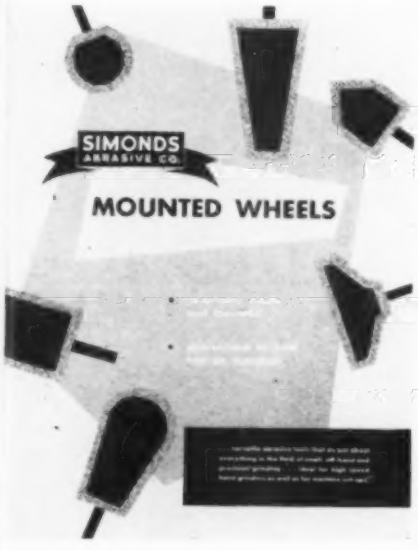
Use postpaid card. Circle No. 3

Centertype Grinding Wheels

"Cincinnati Centertype Grinding Wheels" describes the features and applications of these wheels. It is completely illustrated and contains a helpful table of suggested grinding wheel gradings for various centertype grinding operations.

Cincinnati Milling Products Div., Cincinnati Milling Machine Co., Cincinnati 9, O.

Use postpaid card. Circle No. 4



FREE LITERATURE *continued*

Grinding Wheel Recommendations

Engineering Data Sheet No. 5 lists grinding wheel recommendations for finishing overlays of hard-facing alloys—nickel-base, cobalt-base and iron-base. Part numbers are given for wheels of the following manufacture: Atlantic, Bay State, Blanchard, Carborundum, Cortland, Macklin, Norton, Precision, Robertson, Simonds and Sterling. Recommendations are offered for these grinders: surface (both horizontal and vertical), cylindrical, internal, centerless, and tool room.

Wall Colmonoy Corp., 19345 John R. St., Detroit 3, Mich.

Use postpaid card. Circle No. 5

Pneumatic Spray Systems

Pneumatic spray systems atomize oil in a nozzle of a spray valve by compressed air. They can be used for grinding, milling, drilling, tapping, reaming, sawing. Spray systems of this type may be gravity, syphon, air or pump operated. Each spray valve is equipped with two needle valves, one to control the flow of air and the other to control the flow of oil. Multiple spray valves in a gang-mounted design are desirable for many applications. Each valve may be adjusted individually or, if necessary, shut off entirely without disturbing the performance of the others. The valves can be furnished with the nozzle mounted directly on the valve or at a remote point.

Oil-Rite Corp., 2302 Waldo Blvd., Manitowoc, Wis.

Use postpaid card. Circle No. 6

Air Gages

Catalog 57-D covers complete line of Dimensionair air gages accessories. New model, DA-201, has a range of .006", with a magnification of 1250 to 1. Minimum scale graduations equal .0001". Expanded listing of air plugs includes sizes from .093" to 6.260" in the thru-hole models, with complete specifications and dimensions. Counterbore and blind hole models are also described. Chart shows how gaging ranges are apportioned on the Dimensionair's calibrated scale with relation to size of workpiece dimension and its tolerance.

Federal Products Corp., 1144 Eddy St., Providence 1, R.I.

Use postpaid card. Circle No. 7

Rotary Grinding Attachment

Grinding attachment affords frictionless rotation with pre-loaded angular contact precision ball bearings. Placed on a surface grinder chuck or table, a rotary grinding machine is made in a few minutes. Put on any machine having a spindle with vertical travel, and with the use of an air or electric hole grinder, a precision internal grinding machine is immediately available for straight or tapered holes. Tapers or angles from 0° to 90° can be ground.

Circular from American Standard Co., Plantsville, Conn.

Use postpaid card. Circle No. 8

Optical Height Gage

Folder describes optical height gage as an "accurate yardstick which measures heights up to 61 inches with accuracies of ±.000005" per inch of height." Gage combines Webber gage blocks and the Leitz measuring microscope.

Webber Gage Co., 12912 Trisket Rd., Cleveland 11, Ohio.

Use postpaid card. Circle No. 9

RIBON UNIVERSAL GRINDERS

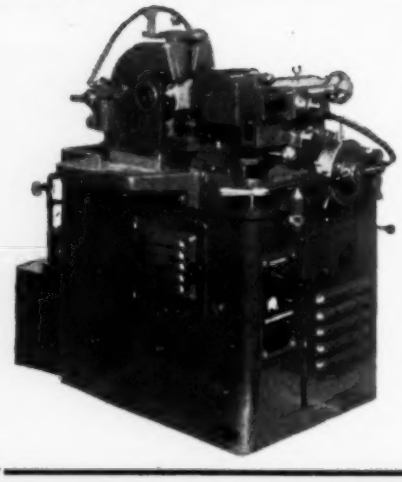
Electro mechanical and hydraulic models produced by one of Europe's largest grinder manufacturers—completely universal with swinging internal grinding heads. 14" x 2" x 5" O.D. wheel with 3 H.P. and 18000 and 35000 I.D. spindles with 1½ H.P. Long conical adjustable plain bearings in both wheelhead and workhead with automatic pressure oil bath lubrication. All machines have automatic table traverse and infeeds.

11" x 20" Electro Mechanical Grinder ...$3450.00
11" x 32" Electro Mechanical Grinder ... 3600.00
11" x 42" Electro Mechanical Grinder ... 3850.00
12" x 20" Hydraulic Plunge Cut Grinder .. 5450.00

All Prices FOB N.Y. or Chicago

LOW COST GRINDERS

Write for Catalog



CENTRI CENTERLESS GRINDERS

Close tolerance production units capable of .0001" tolerances in production. Long conical adjustable plain bearings on both grinding wheel and feed wheel spindles with pressure oil bath lubrication. Equipped for bar feed, thru feed, and infeed work with automatic ejectors and automatic cycling on infeed where desired. Diamond or crush dressing on both wheels with contour form and taper dressing of wheels by either hand feed screw or hydraulically.

Model 0—Work Dia. .020"-½". 10 x 2½ x 5" Wheel with 3 H.P. $1950.00
Model 1—Work Dia. .020"-2". 12 x 4 x 5" Wheel with 5 or 7½ H.P. $3450.00
Model 3—Work Dia. .030"-3". 14 x 7 x 5" Wheel with 16 H.P. $4675.00

All Prices FOB N.Y. or Chicago

THE AMERICAN HERFORDER CORP.
1801 W. COLUMBIA AVE. CHICAGO, ILLINOIS

Use postpaid card. Circle No. 242

Comparator Charts

Catalog folder describes custom comparator charts and coordinated staging fixtures for rapid and accurate part inspection on optical comparators. Of particular interest to users of automated machine tools is the illustration of an aircraft fuel control manufactured on a Gorton pantograph. To assure positive tooling coordination, both pantograph follower template and Magni-gage comparator chart are photographic reductions from a single precision master layout.

Industrial Lofting & Mfg. Co., Inc., Bridgeport, Conn.

Use postpaid card. Circle No. 10

Grinder, Buffers, Polishers

Profusely illustrated folder presents complete line of grinders, polishers, buffers. Infinitely variable speed, belted and direct motor drive, ¼ hp to 100 hp. Air-rester dust collectors claim efficiency for the majority of industrial dust collecting problems. They collect buffing lint; polishing, grinding, abrasive belt grit and dust, and salvage precious metals.

Standard Electrical Tool Co., Cincinnati 4, Ohio.

Use postpaid card. Circle No. 11

Internal Grinding Attachment

High speed spindles presented in catalog sheet mount on R-O grinder column and permit the grinding of both axial and radial relief when used in conjunction with universal form relieving fixture. The Vulcanaire, Series 10,000, is an air-powered spindle with maximum speed of 65,000 rpm. The Precise, Super 60, is an electric-powered spindle with maximum speed of 45,000 rpm.

Royal Oak Tool & Machine Co., Royal Oak, Mich.

Use postpaid card. Circle No. 12

Grinding Wheel Dressers

Specially designed for Blanchard and similar grinders, these wheel dressers are claimed to save time, labor, material. Model 7, trim for new segments, is placed on magnetic chuck and the wheel is positioned to bring all segments into contact. Trueness is thereafter maintained with permanent-type dresser. No. 7A, for finer grit segments, is used in the same manner as No. 7.

Bulletin distributed by Frank Loy & Assoc., 2890 W. Valley Blvd., Alhambra, Calif.

Use postpaid card. Circle No. 13

Tool Grinders

Carbide tool grinders, Model EE, heavy duty wet type; Model AA, floor and bench types; Model AW, wet type; precision tool grinders Model AP, bench and floor types; Model APW, wet type, are presented in three folders. Smooth vibrationless operation reduces scoring of wheels. Quick-acting tables save time.

Thomas Prosser & Son, Felter Bldg., Tenafly, N.J.

Use postpaid card. Circle No. 14

for less than $200

equip your LATHE or similar machine for precision grinding WITH AN Onsrud® AIR TURBINE GRINDER

The 50,000 RPM ½ HP Onsrud D1-GB Air Turbine Grinder shown here, mounted on a lathe, provides surface finishes of 3 to 4 RMS in internal and external surface grinding operations. Construction features include pre-loaded bearings and dynamically balanced spindle. Governor control maintains full power and speed under load . . . gives air economy at idling.

For a total cost of less than $200 a precision-built Onsrud Air Turbine Grinder can be yours for low cost precision internal and external grinding on your lathe or similar machines. You'll find Onsrud Grinders have the extra power, speed and precision to more than do the job. Write for D1-GB Air Turbine Grinder Bulletin.

ONSRUD MACHINE WORKS, INC. PORTABLE TOOL DIVISION

3945 Palmer Street Chicago 47, Illinois

Onsrud® quality AIR TURBINE TOOLS

Use postpaid card. Circle No. 243

FREE LITERATURE *continued*

X-Ray Equipment

A series of portable, industrial x-ray equipment, for radiographic inspection of castings, welds, assemblies, and which facilitates improvements and repairs on metal products, is illustrated and described in a 4-page folder. The three compact units of the MS series—with respective KVP ranges of 55-200, 70-260, 70-300—have built-in high tension transformers, simplified, color-coded technique charts on the face of the control panels, and protective devices for overload, high voltage, excessive voltage and excessive oil temperature.

Mitchell Radiation Products Corp., 128 East Washington St., Norristown, Pa.

Use postpaid card. Circle No. 15

Water Soluble Coolant

Hamikleer, liquid that acts as a coolant, lubricant and rust preventive when mixed with water is shown in use and fully described in an 8-page booklet. Coolant reduces rejects by keeping work clean and visible, assuring finer surface finishes.

Harry Miller Corp., 4th & Bristol Sts., Philadelphia 40, Pa.

Use postpaid card. Circle No. 16

Tool Room Production Grinders

Bulletin 618 describes Series 618 tool room and production grinders. Three models are available: 618-P, power table, power cross feed; 618-PT, power table, hand cross feed; 618-H, hand table, hand cross feed. Various accessories and attachments for use with the grinders are also described.

Reid Bros. Co., Inc., Beverly, Mass.

Use postpaid card. Circle No. 17

Measuring Devices

Among the items listed in Catalog No. 57 are reversible plain and thread plug gages, AGD thread ring gages and setting plugs, adjustable limit snap gages, ring gages and master setting discs, thread and gear measuring wires and centerless lapping machines.

Size Control Co., Div. of American Gage & Machine Co., 2500 W. Washington Blvd., Chicago 12, Ill.

Use postpaid card. Circle No. 18

Heavy Duty Fans

A 24-page bulletin (MD-102) explains the construction, operations, and specifications of a rugged line of fans designed for heavy industry, commercial installations, and public buildings. The direct drive units, constructed of either cast iron or steel housings, utilize a forward curved aluminum wheel and streamlined inlets to produce a low operating noise level at optimum output. Available in nine different sizes, these fans are furnished for 90 degree adjustment as to position of discharge.

Chicago Blower Corp., 9863 Pacific Ave., Franklin Pk., Ill.

Use postpaid card. Circle No. 19

MOORE SPECIAL TOOL COMPANY — Holes, Contours, Surfaces

Published in the interests of greater accuracy and quality in the toolroom and on the production line by the Moore Special Tool Co., Inc., 725 Union Ave., Bridgeport 7, Conn., builders of Jig Borers, Jig Grinders, Panto-Crush Wheel Dressers, Precision Rotary Tables, Motorized Centers and a complete line of Hole Location Accessories.

7 Tricks of the Trade in Jig Grinding Small Holes

The following tricks of the trade will prove helpful in jig grinding small holes with a diamond-charged mandrel:

1. Uniformly graded diamond powder should be used for charging mandrels. Holes from minimum (1/64") to about 3/32" in diameter should be roughed and finished with 80-100 grit powder. Larger holes may be roughed somewhat more rapidly with a coarser grade, 60-80 grit.

2. Avoid bellmouth by preventing the mandrel from leaving the hole at either end.

3. Since a freshly charged mandrel will cut much more rapidly than a worn one, avoid introducing a freshly charged tool as a hole nears size, Fig. 1.

4. Do not permit the uncharged *shank* of a mandrel to contact the surface being ground. Frictional heat will burn both the work and the mandrel. The former, partially annealed at point of such contact, will charge with diamond sut and probably be ruined.

5. It is generally more economical and efficient to consider mandrels as expendable and make a new one for each job. Since the cost is only a few cents, use of an old one, or even the time spent trying to match one to requirements, is hardly justified.

6 Because mandrels cannot be trued with a diamond, it is necessary to measure both the top and bottom of a hole while grinding, in order to avoid a ridge.

7. In view of point 6, it is advisable to set the work up on parallels of sufficient height to enable measurement from beneath the workpiece, Fig. 2.

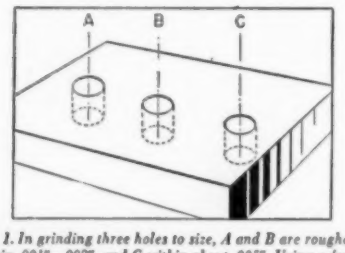


Fig. 1. In grinding three holes to size, A and B are roughed to within .001"–.002", and C within about .005". Using a freshly charged mandrel, C is finished to size, thereby breaking down the high points on the tool. A and B may now be safely ground to size.

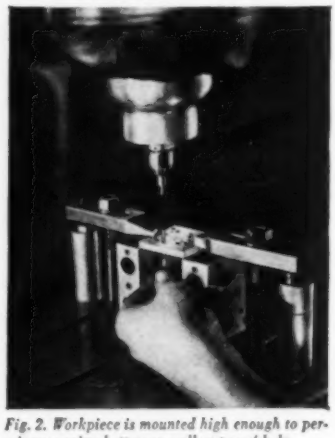
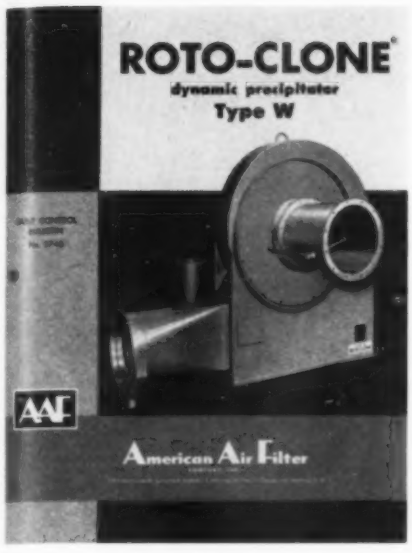


Fig. 2. Workpiece is mounted high enough to permit measuring bottom as well as top of hole.

Get ALL the answers from this new, 424-page book

The information on this page is just a sample of the valuable, on-the-job aid you can get from Moore's *all-new* book, HOLES, CONTOURS AND SURFACES. Tells you how to produce tools, dies and precision parts *the modern way*. 424 pages, 495 illustrations. 184 pages of Woodworth Coordinate Location Tables from 3 to 100 holes. Price only $5 in U.S.A., $6 elsewhere. Send check or money order to Moore Special Tool Co., Inc., 725 Union Ave., Bridgeport 7, Conn.

Use postpaid card. Circle No. 244



Dust Control

Bulletin discusses the operation of the Type W Roto-Clone dust collector, explains its distinguishing feature, the addition of a water spray to the basic principle of dynamic precipitation. The spray maintains a flowing film of water on collecting surfaces, which lowers the water requirements to a minimum, traps even the lightest and finest dust particles, and delivers collected dust in slurry form for easy disposal. Unit is available in 12 sizes: from 1000 to 50,000 cfm.

American Air Filter Co., Inc., 215 Central Ave., Louisville, Ky.

Use postpaid card. Circle No. 20

Carbide Dies

8-page booklet describes complete carbide tool and die service offered by Jaquith Carbide Div. of Pratt & Whitney. Company offers to take die problem or project from part print through to finished, ready-to-run die. Experience includes dies for blanking, forming, cold-heading, cut-off, drawing, swaging, compacting and impact extrusion as well as carbide wear parts, jigs and fixtures.

Jaquith Carbide Div., 19 Stewart St., Lynn, Mass.

Use postpaid card. Circle No. 21

Gravity Conveyor

Application ideas and features of Rapistan Flow Track are described in a new bulletin recently published by Rapids-Standard of Grand Rapids.

Rapistan Flow Track, gravity conveyor in its basic form, can be combined with other conveyors or be used in various combinations by itself for a multitude of purposes. Form No. FT-57.

The Rapids-Standard Company, Inc., 342 Rapistan Bldg., Grand Rapids, Mich.

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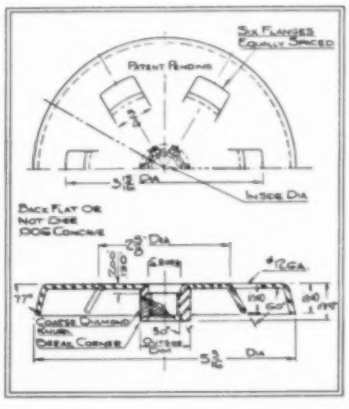
CARROLL'S NEW SAFETY GUARD INSERT gives you Built-In Operator Safety and Top Performance



Now you can have built-in Operator Safety on every portable grinding wheel you produce or use, at very low cost. This radically new Safety Guard Insert with its intergrated revolving guard gives you the all-important safety factor with increased wheel strength and efficiency.

Added economies in production are gained from the ready-made molding form provided by the Guard. Truing of the wheel back is eliminated and true dynamic balance, back flatness and concentricity, show consistently close tolerances within .010 T.I.R.

Safe grinding wheels mean increased production — use and specify wheels with the new Carroll Safety Guard.

FEATURES:

- HIGHEST SAFETY FACTOR • ONE PIECE ASSEMBLY • NO ADJUSTMENT NECESSARY
- PATENTED CARROLL LOCKING DEVICE • INCREASED STRENGTH • LIGHT WEIGHT
- FOOL PROOF MOUNTING • TRUE DYNAMIC BALANCE
- A POSITIVE GUARD ON EVERY CUP WHEEL

Write for Information on Carroll's New Safety Guard Insert

Dept. B

CARROLL PRESSED METAL, INC.
133 DEWEY ST., WORCESTER 2, MASS.

Use postpaid card. Circle No. 245

FREE LITERATURE *continued*

Rotary Table

Pratt & Whitney 36-inch tilting rotary table is shown in a new circular. Intended for large jobs requiring precise circular spacing and angular positioning, the table has power tilting, power rotation, plus speed and ease of operation. Direct reading of table position to two seconds of arc can be made on the rotary vernier dial.

Pratt & Whitney Co., Inc., Charter Oak Blvd., West Hartford 1, Conn.

Use postpaid card. Circle No. 23

Stainless Fabrication

"Fabricating the Stainless Steels" is the title of a 12-page issue of Eutectic Welding Alloys' semi-monthly Technical Information Digest. The manual discusses metallurgy, welding, preheating, annealing, stress relieving and fluxing. Numerous illustrations of practical work on the difficult steels are given.

Eutectic Welding Alloys Corp., Flushing 58, N.Y.

Use postpaid card. Circle No. 24

WHITNON
Precision SPINDLES

Rated Double A for Absolute Accuracy!

Absolute dependability and balance is assured by dynamic electronic balancer that checks spindles after assembly — to provide the ultimate in on-the-job perfection.

America's finest complete line of Precision High Production Spindles for Boring, Grinding, Milling and Drilling

Whitnon precision Spindles have been developed for new and replacement applications. The extra rigidity from large spring pre-loaded bearings assures constant chatter-free life.

Correct pre-loading mechanisms keep Whitnon Spindles and bearings tight at all times to compensate for changes created by temperature variations and wear.

Whitnon Spindles for Milling and Engraving will increase the output of your machines. Whitnon-held tools cut on all lips, hence tools cut better, faster and last longer . . . producing a finer finish.

Whitnon Spindles are built for high speed and long life. Drills stay sharp and produce a straight and round hole.

Write for Literature Today.

THE Whitnon MANUFACTURING COMPANY
ROUTE 6 AND NEW BRITAIN AVE., FARMINGTON, CONNECTICUT

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Free Machining Steel

"Elastuf Penn" is the name of a machinery steel, .45% carbon special analysis, to supply the need for a free-machining medium carbon steel with superior mechanical properties. Uniform structure is claimed by careful control of manganese and sulphur and minimizing residual elements. This gives superior machinability, according to the maker.

Horace T. Potts Co., Erie Ave. and D St., Philadelphia 34, Penna.

Use postpaid card. Circle No. 25

Sine Plate

A triple compound sine plate with permanent magnetic chuck which has angular adjustments in three planes, permitting the possibility of obtaining every possible combination of angles, is presented in flyer. All rolls are 4" apart, hence, sine of angle x 4 is used for horizontal setting and sine x 4 + .300" for the two other settings. The base of the Multi-Sine has four rolls of equal size on all four corners, square and four inches equidistant on all sides.

American Standard Co., Plantsville, Conn.

Use postpaid card. Circle No. 26

Drum Cleaning

Fast, efficient removal of dirt, rust, paint and other foreign materials from drum exteriors, interiors and lids by Rotoblasting is described in specification bulletin. The ES-382 automatic drum cleaning machine cleans covers and drums inside and out with a single Rotoblast wheel. Automatic loading techniques of 30-55 gallon drums, production cost studies, operator safeguards, engineering specifications and diagrams are included.

Copies of Bulletin No. 220 are available from the Pangborn Corp., Hagerstown, Md.

Use postpaid card. Circle No. 27

Grinding and Finishing

New Equipment and Materials

For further information on any of the products listed here, use the handy postpaid card opposite this page.

Hydrabrasive Surface Grinder Line Announced

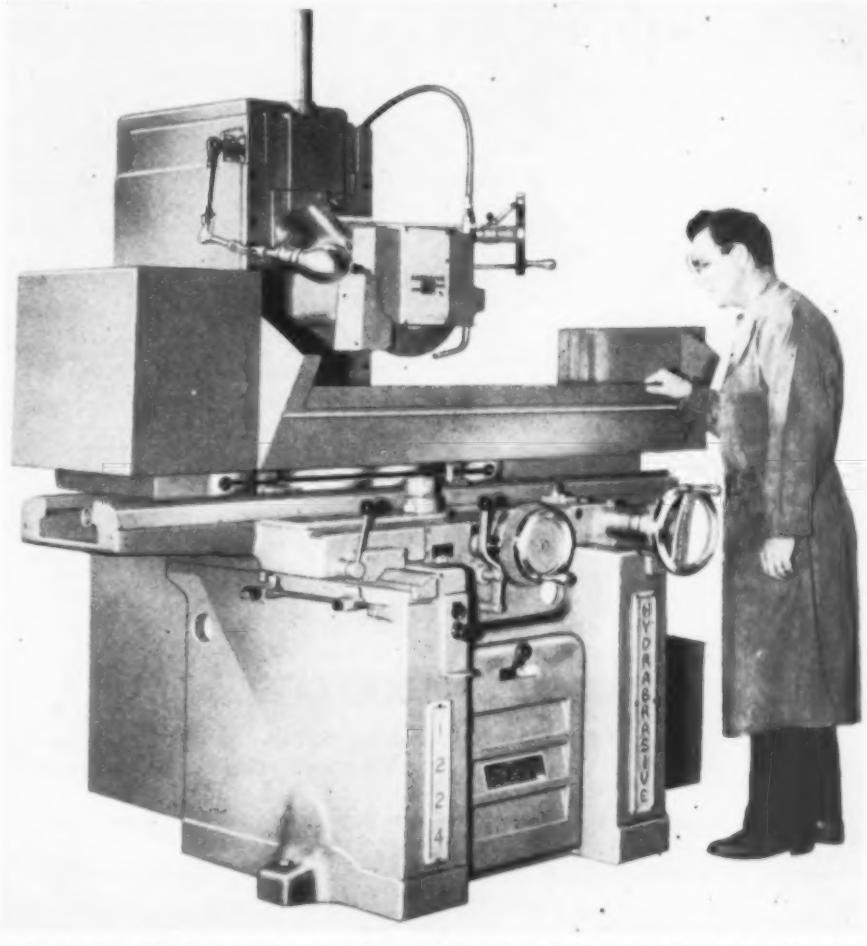
Abrasive Machine Tool Company, East Providence, Rhode Island, has unveiled a new line of hydraulic precision surface grinders, the Hydrabrasive Numbers 824, 1218 and 1224. The new line boasts many surface grinder innovations, highlighted by big capacity, a new spindle design, a new design minimizing heat generally encountered with hydraulic powered machine tools, and a unique cross-feed saddle adjustment.

The new line includes the three most wanted precision surface grinder sizes; 8″ x 24″ x 12″, 12″ x 18″ x 12″ and 12″ x 24″ x 12″.

To provide flexible capacity, all standard Hydrabrasive models have 12″ of grinding clearance to the table under a 12″ wheel. Optionally, they can be built with 18″ under a 12″ wheel. Also, 24″ models can be safely extended to 30″ in length without sacrificing strength or accuracy.

For trouble-free operation, the Hydrabrasive spindles are lifetime sealed lubricated. They have anti-friction preloaded bearings. Spindles are precision ground and are powered by special "soft" running motors. To eliminate possibility of binding on the column ways, the head and spindle assembly is balanced on the elevating screw. The whole spindle unit hangs straight on the column ways.

The new designs minimize heat usually associated with hydraulically powered machine tools. The Hydrabrasives have two hydraulic cylinder rams to actuate the table. Each ram is under pressure only half of the time. Oil cushions absorb shock at the end of each stroke. The ram is the piston in Hydrabrasives, a design advancement which eliminates piston rods. The hydraulic system is low pressure, 200 lbs. operating pressure, and is small, compact and simple. It is easily removed for inspection or maintenance. Normal temperature rise in the system is only 20°F. The entire power unit is cooled by a large volume air flow over the system and up the column aided by a T.E.F.C. motor. For inspection, the power system rolls on casters out the front of the machine. The coolant sys-



Hydrabrasive 1224, largest of surface grinder line being introduced by Abrasive Machine Tool Co.

REASONS *why*

RUSCO

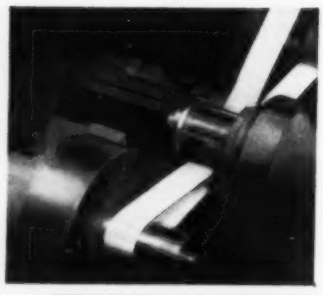
ultra-speed

Out-performs all other

TRANSMISSION BELTS

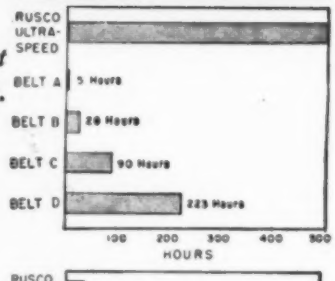
1. ***ultra-speed*** ***belts operate at higher speeds and over smaller diameter pulleys.***

Engineered for all speeds to 100,000 rpm and over, Rusco ULTRA-SPEED belts withstand the severe flexing action of small diameter pulleys. In fact, ULTRA-SPEED can be used over smaller pulleys than any other type of flat transmission belt.



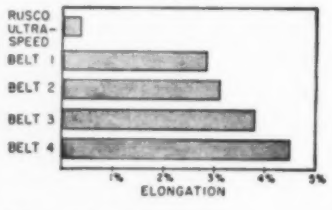
2. ***ultra-speed*** ***belts outlast all other flat belts at ANY OPERATING SPEED.***

Competitive belts failed on a 30,000 rpm drive as shown, while the ULTRA-SPEED belt was removed in perfect condition after 516 hours of operation. Here's proof of real in-service economy.



3. ***ultra-speed*** ***belts are stretch resistant.***

By test, Rusco ULTRA-SPEED belts stretch as little as ½ of 1%—⅛ as much as the closest competitive belt. Take-up requirements are far less. More positive traction is assured.



Prove the superiority of Rusco ULTRA-SPEED on your most difficult drive. If it does not outlast any other type of flat high speed belt you've ever used, your full purchase price will be refunded.

Contact your local Rusco distributor or write for full information about

RUSCO ULTRA-SPEED

. . . the flat high speed transmission belt that outlasts all others—regardless of operating speed or minimum pulley diameter.

THE RUSSELL MANUFACTURING CO.

ENGINEERED FABRICS SINCE 1834

115 East Main Street • Middletown, Conn.

Use postpaid card. Circle No. 247

HYDRABRASIVE CONTROLS are grouped for natural operation, are mechanically interlocked for safety. (1) Power table feed lever (2) Table reversing valve (3) Controls infinitely variable table speeds and when pulled out selects continuous variable saddle feed for wheel dressing. (4) Actuates power saddle feed (5) Varies cross-feed from 0" to 3/8" (6) Is the hand saddle feed (7) Table hand feed wheel (Hand feed on this power-operated grinder is standard equipment) (8) One-shot lubrication system.

tem is located outside of the machine, eliminating heat transfer from that source.

Another engineering advancement is the newly designed cross-feed. For highly accurate transverse saddle adjustment, Hydrabrasives have a precision ground cross-feed screw with backlash eliminator and ball bearing saddle ways. The saddle moves on ¾" steel pre-loaded ball bearings on hardened steel square ways. The hydraulic motor turns the screw for rapid saddle transverse when dressing wheel.

Abrasive says their Hydrabrasive line is designed from the operator's viewpoint. For example, all Hydrabrasive controls are grouped for natural operation, and are mechanically interlocked for safety. Specifically, Abrasive points out that the elevating hand wheel is located on the head to eliminate crouching to line up work. Each control is engineered to allow the operator to work in a natural, comfortable position during each operation.

In common with the entire Abrasive line, the new Hydrabrasive surface grinders feature easily maintained unit construction.

Abrasive Machine Tool Co., Dexter Rd., E. Providence, R.I. •

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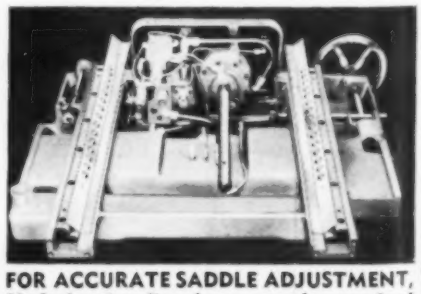
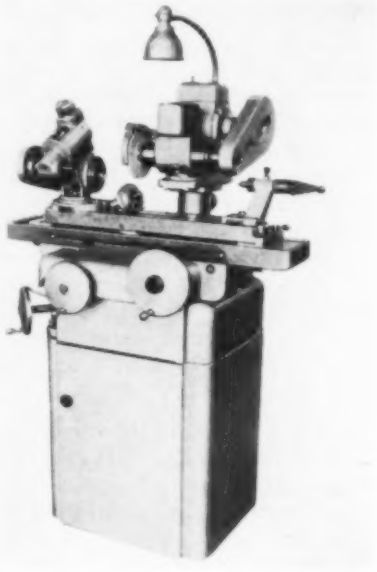


FOR ACCURATE SADDLE ADJUSTMENT, Hydrabrasive line has ground cross-feed screw with backlash eliminator (not shown) and ball bearing saddle ways. Saddle moves on ¾" steel preloaded balls on hardened steel square ways. Hydraulic motor turns screw for rapid saddle traverse when dressing wheel.

Tool Grinder Series Announced by K. O. Lee

A new series of universal tool and cutter grinders has been introduced by the K. O. Lee Company, Aberdeen, South Dakota. The B900 Series includes: Model B900 Tool and Cutter Grinder, Model B960 Universal Tool Grinder equipped with dovetail slide mounted multiple speed head, and Model B900X Basic Tool Grinder. The B900X machine can be converted to a carbide grinder with the addition of a tilting table attachment and universal work holding fixture.

The new Lee grinders have improved accuracy standards, greater capacities, 25% heavier construction, V-type saddle, larger table ways, improved lubrication system giving longer life, and



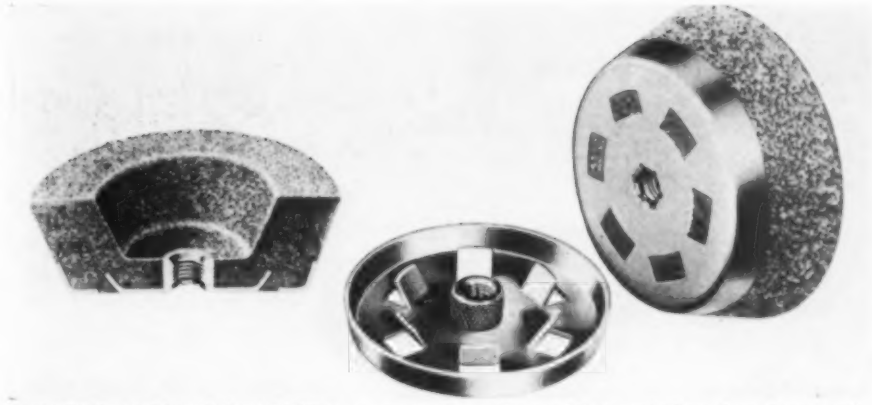
many refinements for easy operation. New engineering features simplify and minimize time in making setups for almost every operation. The grinders are available with hydraulic power unit for table traverse.

Condensed specifications include: Swing over table 8¼" (with 1" raising blocks, 10¼"). Distance between centers of head and tail stocks 20¾". Table Dimensions: Working surface 5¼" x 27¼", Sub-table 8" x 36".

Available are a large selection of fixtures adaptable to the B900 series grinders. Partial list includes: motor driven work heads, tap grinding fixtures, tilt table attachments for forming and sharpening cemented carbide tools, high speed grinding attachments, radial grinding fixtures, universal work holding fixtures, sensitive work heads, diamond dressers, and cutter and hob grinding arbors.

K. O. Lee Co., Aberdeen, South Dakota. •

Use postpaid card. Circle No. 102



GREATLY INCREASED SAFETY in use of angle portable grinders has been substantially accomplished with Safety Guard Insert just announced to grinding wheel manufacturers. New wheel mounting was developed by the Carroll Pressed Metal, Inc., Worcester, Mass. Inquiries made of portable grinder users indicate that users do not employ conventional separate cup guard attachments because of extra handling and mounting time. With new insert, grinding compound is "locked-in" at three points. A comparison between standard wheels and separate conventional guards revealed that grinding wheels mounted with the Safety Guard Insert were 25% to 40% safer to use. The insert eliminates need of reinforcing rings, pronged anchor bushings, and individual mounting nuts.

Use postpaid card. Circle No. 103

PRECISION MOTOR-DRIVEN SPINDLES OR WORKHEADS

PRECISION BELT-DRIVEN SPINDLES OR WORKHEADS

RUGGED CONSTRUCTION
Plus
DYNAMIC BALANCE
Plus
PRECISE ENGINEERING
OF STANDARD SPINDLES
Equals
SPECIAL MACHINE TOOL PERFECTION!

In nearly 500 American and foreign plants, STANDARD spindles are doing a top production job as modernizing applications on old machines, and in special adaptation for custom jobs.

GOT A TOUGH PROBLEM?
Our custom engineering department has or will get the answer for you. Tell us about it today

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PRECISION SPINDLES AND MACHINE TOOLS

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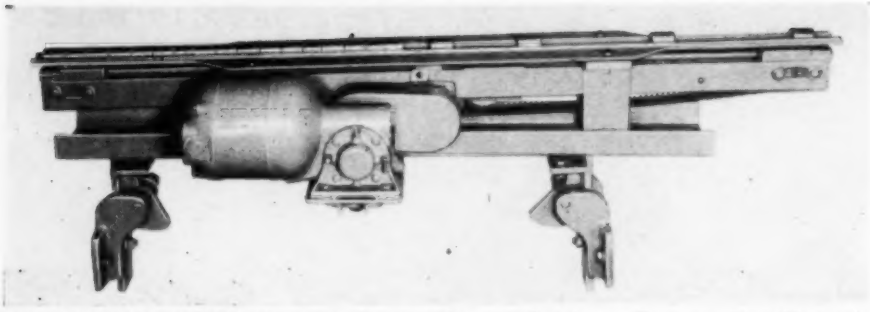


THRU-FEED CONVEYOR for centerless grinding applications—Features long-life positive drive chain belt with ratchet-type adjustment, and is capable of handling ¼" to 3½" diameter work at preset speeds; wide splash pan conserves coolant and keeps work area clean. Self-contained unit swings clear to allow easy changing of grinding wheels and is adjustable at each end for height and also 1½" for length to insure alignment between machines. Recommended lengths are 52½" for 20" grinders and 63½" for 24" grinders. DePauw Industries, 316 North 7th St., St. Charles, Ill.

Use postpaid card. Circle No. 104

"most used grinder" say customers

In checking with the tool, die, gage and general production shops that use SANFORD SURFACE GRINDERS, the most frequent comment was that Sanford Grinders were the "most used" of any grinders in the shop.

WET or DRY Model MG

PARTIAL SPECIFICATIONS—

Capacity — 8" x 12" x 12".
Table travel — 13", traverse 8¾".
Vertical clearance 12" under 7" wheel.
Standard grinding wheel — 7" x ½", 1¼" hole.
Spindle speed approx. 3000 RPM.
Motor, ½ HP, single or 3 ph., dynamically balanced.
Floor space — 45" x 38" x 62" high.
Net wt. with stand approx. 630 lbs.

Others have tried to copy but there's a "feel" that comes from the precise individual quality and workmanship that goes into every SANFORD GRINDER. It's the factor that can't be found in any other grinder.

So widely used you can ask users in your own area how they like the low priced Sanford Surface Grinder.

Write for illustrated and fully descriptive literature, reconditioning facilities, optional equipment and prices.

Representatives in major industrial areas

SANFORD MANUFACTURING CORP. 1026G Commerce Ave., Union, N. J.

Use postpaid card. Circle No. 249

Heavy Duty Soluble Oil

A new emulsified cutting oil which substantially increases the efficiency of many heavy-duty machining and grinding operations has been announced by Gulf Oil Corporation.

The new oil is Gulfcut Heavy Duty Soluble Oil, which effectively combines the cooling ability of water with the lubricity and protection of oil.

Six years of Gulf research and development are behind the new product, which makes possible lower machining costs through longer tool life, heavier cuts, and higher speeds and feeds. These user benefits are said to apply to all metals, particularly those with low machinability ratings.

Chemically-active compounds protect against foaming and welding. Wetting-out properties are high, providing more effective cooling. Other benefits of this new soluble cutting oil, which contains a stable petro-chemical emulsifier, include superior surface finish as well as greater protection from rust and corrosion.

In grinding operations, in particular, Gulfcut Heavy Duty Soluble Oil gives exceptional results, with good finishes and minimum wheel loading and breakdown.

During field testing of this new product, which contains 9 major components, mixtures ranged from 5-1 to 150-1. Average mixture is 25 parts water and one part Gulfcut Heavy Duty Soluble Oil.

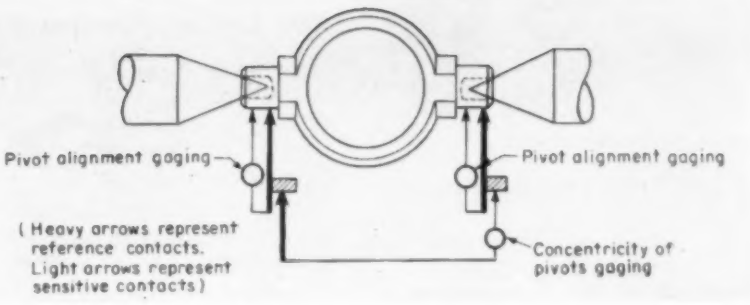
Applications include: Heavy hogging cuts, fast fine cuts, boring and grinding of ferrous and nonferrous metals and alloys, including tough titanium alloys.

An example of Gulfcut's surface finishing qualities on aluminum was obtained during field tests. The test took place in the plant of a refrigerator compressor manufacturer. The new cutting oil was used in a turning operation to produce a 5 microinch finish on an aluminum piston and connecting rod.

Already in use by a number of machine shops, Gulfcut Heavy Duty Soluble Oil has contributed to these results: Increased boring speeds 3 to 1; ground 100 parts without requiring tool dressing where formerly less than 50 parts were ground between dressings, and increased depth of cut from ¼ to ½ inch per pass.

Gulf Oil Corp., Gulf Bldg., Pittsburgh, Penna. •

Use postpaid card. Circle No. 105


Pivot alignment gaging
Pivot alignment gaging
(Heavy arrows represent reference contacts. Light arrows represent sensitive contacts)
Concentricity of pivots gaging

ALIGNMENT OF EACH PIVOT with the centerline of the pivot is checked by comparing the relative position between paired fixed and sensitive contacts at each pivot. Concentricity of one pivot with the other is measured by comparing the relative position between the fixed reference contacts on each pivot.

Gage Measures Concentricity, Alignment of Gimbals

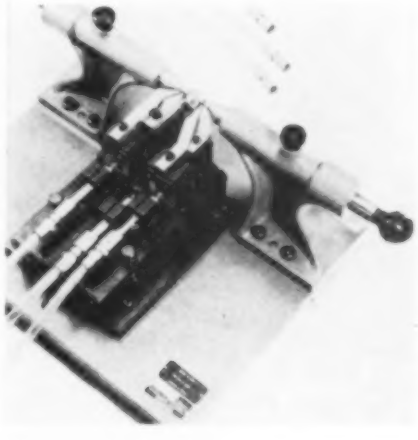
A special gage has been developed by Federal Products Corporation to check gyro gimbals for alignment of each pivot with the centerline of the gimbal and concentricity of one pivot with the other. The three readings are indicated simultaneously on dials of a triple-unit air gage. Dials on gages supplied were graduated to 20 millionths of an inch. Since the gage makes three checks simultaneously with only a single handling of the workpiece, it has greatly reduced the time required to determine part acceptability.

As developed for a manufacturer of missile guidance systems, the gage has a fixture containing precision centering stocks which support and position the gimbal during the gaging operation. The gimbal is rotated to obtain total indicator readings. Any lack of alignment between a pivot and centerline of the gimbal will be evidenced by a wobble of the pivot as the piece is rotated. This motion will change the relative position between a pair of contacts bearing on either end of each pivot. The longer contact of each pair is reed pantograph mounted to a platform so that it is free to change its position relative to the short solidly mounted reference contact when such motion occurs. Since each pivot alignment is checked separately, the two side-by-side platforms are independent. An air probe gage head, solidly mounted on each platform, contacts the sensitive pantograph and transforms its motion into a corresponding air pressure variation which is magnified within the triple unit Dimensionair and displayed on each of the outer dials. Acceptability tolerances for alignment and concentricity in this application are 0.0001 in.

While this gage was developed for a very small gimbal, Federal Products reports that it has developed other techniques to gage, to the same order of accuracy, much larger gimbals of two feet or more in diameter. Equally important, these techniques can be applied not only to the gaging operation, but also to the critical problem of positioning parts accurately when machining them to tight tolerances such as those now required for these precision assemblies.

Federal Products Corp., 1144 Eddy St., Providence, R.I. •

Use postpaid card. Circle No. 106



SPECIAL AIR GAGE developed by Federal Products for checking alignment and concentricity of gyro gimbals. Shorter contacts are reference contacts rigidly mounted to their respective sides of the split platform. The longer contacts are the sensitive contacts pantograph mounted so that they are free to float. Their motion is transferred to air gaging spindles.

if we can't cut your grinding costs . . . . . we'll say so!

But We Usually Cut Them By 85-90%!

Where there is room for improvement — in abrasive costs, removal rates, finish — we will be the first to help you investigate thoroughly the advantages of Anocut Electrolytic Grinding. Should our process be adopted, our engineering service department will keep in close contact with you, continually striving for further improvement.

For these reasons, all users of Anocut Electrolytic Grinding are realizing significant economies over their previous or alternate grinding methods. In fact, over 50% of our output is sent to satisfied customers who are continually reordering.

Listed in coupon are those materials with which we have had much success. Check those you are interested in for literature and data.

ANOCUT® Engineering Company
631 WEST WASHINGTON
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Send me information on Electrolytic Grinding of:
( ) Carbide tools and cutters
( ) Hardened steels
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( ) High temperature alloys
( ) Other
( ) Have a Representative Call

Name _____
Company Address _____
City _____ State _____

Use postpaid card. Circle No. 250

Form Dresser

The Clearview Radi-Angle Form Dresser is said to meet the long-felt need for better visibility of the diamond dresser as it approaches the grinding wheel. Secret is a good-size hole bored through the spindle. In addition, a powerful specially-ground fixed focus lens is added, and according to the manufacturer, you can really see what you're doing. With the removable diamond slide located at the front of the swing arm, radii can be set with gage blocks, but without touching the diamond on the blocks, and without removing the tool from the grinder. With vernier angle markings and movable angle stops, angles can be set and dressed very accurately without the use of a sine bar. Tool is designed so that it can be easily set on a 5-inch sine bar, however. Overall height is 4 inches, length 8¼ inches. Maximum width grinding wheel 1⅛ inches with two 45° angles. Price $285 plus postage.

Clearview Radi-Angle dresser.

Glover Mfg. Co., 422 Park Ave., Meadville, Penna. •

Use postpaid card. Circle No. 107

Carborundum Announces New Line of Mounted Wheels

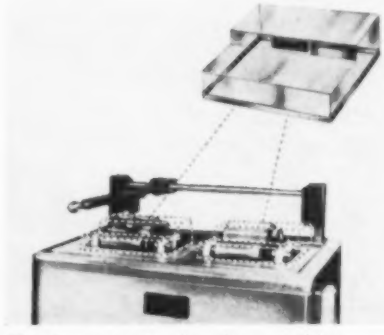
A new line of V40 Mounted Wheels in all industry standard shapes and sizes and in a complete range of gradings has been announced by The Carborundum Company.

A new type of stronger vitrified bond, known to the trade as "V40," was introduced over two years ago by Carborundum for toolroom grinding wheels. This same V40 bond is Carborundum's answer to the need for an improved mounted wheel. The exceptional strength and free-cutting qualities of V40 bond permit extra-fast stock removal with a minimum of pressure, according to the manufacturer. Another characteristic of V40 bond is its ability to hold size and shape exceptionally well.

V40 Mounted Wheels can be supplied with nickel-plated mandrels in a variety of sizes to fit various chucks and to meet the demands of many operations. A special cement, high in strength and hardness, is used for anchoring the abrasive.

Bonded Abrasives Division, The Carborundum Co., Niagara Falls, N.Y. •

Use postpaid card. Circle No. 108



Plastic cover for lapping machine.

Plastic Cover for Centerless Lappers

To provide protection for exposed working parts of centerless lapping machines, Size Control Company, Chicago, has developed a rigid plastic hood. Now included with the purchase price of the firm's new machines, the hood is being offered for sale to present lapping machine owners.

The new hood is molded of polystyrene and finished with a steel band, affording strength and protection against dust, dirt and moisture.

Siz Control Co., 2500 W. Washington Blvd., Chicago 12, Ill. •

Use postpaid card. Circle No. 109

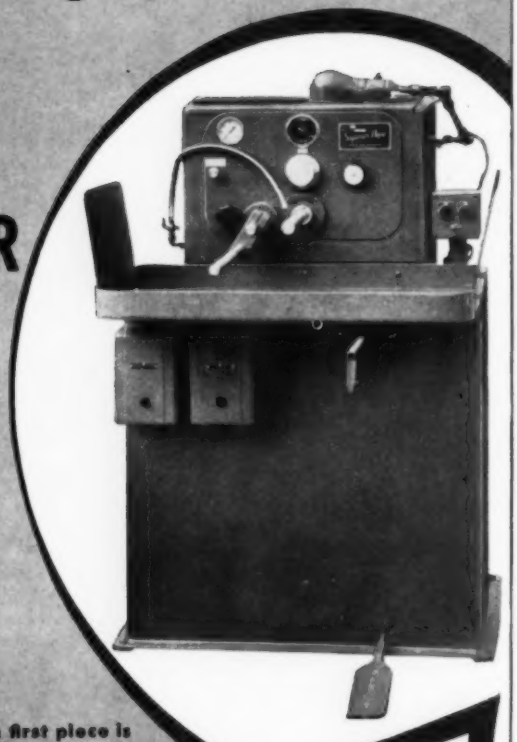
BE WAY AHEAD—YEARS AHEAD in Your Honing Operations—

WITH THE

SUPERIOR

MODEL H. M.

HONEMASTER



★THE RIGHT SPEED (infinitely variable 250 to 1150 r.p.m.) and CORRECT STONE PRESSURE (fully adjustable) makes for BETTER WORK OF ANY FINISH, DIAMETER OR MATERIAL.

★CONSTANT PRESSURE with no fall off due to stone wear or stock removal. CONSTANT CUTTING ACTION ALWAYS.

★Single control dial shows when first piece is coming to finish size. Set, then compensate only for stone wear thereafter.

★Hydraulic clutch and brake.

★FOOT and KNEE operating pedals.

SUPERIOR HONE CORPORATION

1637 Elreno Street • Elkhart, Indiana

Please send full details and prices on the Honemaster.

NAME_____

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NAME OF SUPPLIER_____

Stocked in all principal cities

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Diamond Compound in Throwaway Applicator

Now packaged in an easy-to-use hand plastic throwaway applicator, Super-Lap Diamond Compound can be applied directly to lap or work. Control of the amount used is maintained by a pressure seal plunger.

Compound is protected from contamination by an air seal cap that attaches when the applicator is not in use. The new unit is available at no extra charge and eliminates the cost of a separate applicator.

Each throwaway applicator contains 5 grams of Super-Lap, color-coded for identification of grade. The applicator itself is also labeled with grade numbers.

Acme Scientific Co., 1450 W. Randolph St., Chicago, Ill. •

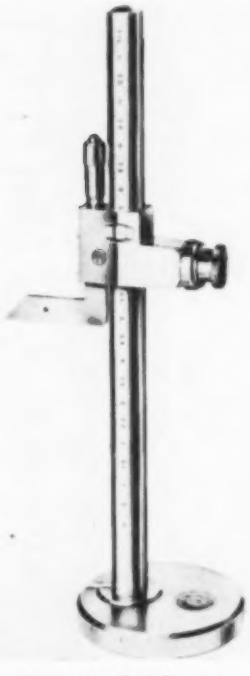
Use postpaid card. Circle No. 110

Micrometer Height Gage

Foster Supplies Co. announces the newly designed "Microball" height gage. Positive action is controlled by indexing at .500 inch intervals, by means of hardened steel balls set in stainless steel column. Intermediate settings are made by operating micrometer gage incorporated in the design, reading direct to within a tolerance of .0005". This gage is easy to read without the aid of magnifying devices and eliminates vernier scale. Corrosion and glare is eliminated by a heavy satin chrome finish.

Foster Supplies Co., 6122 Milwaukee Ave., Chicago 30, Ill. •

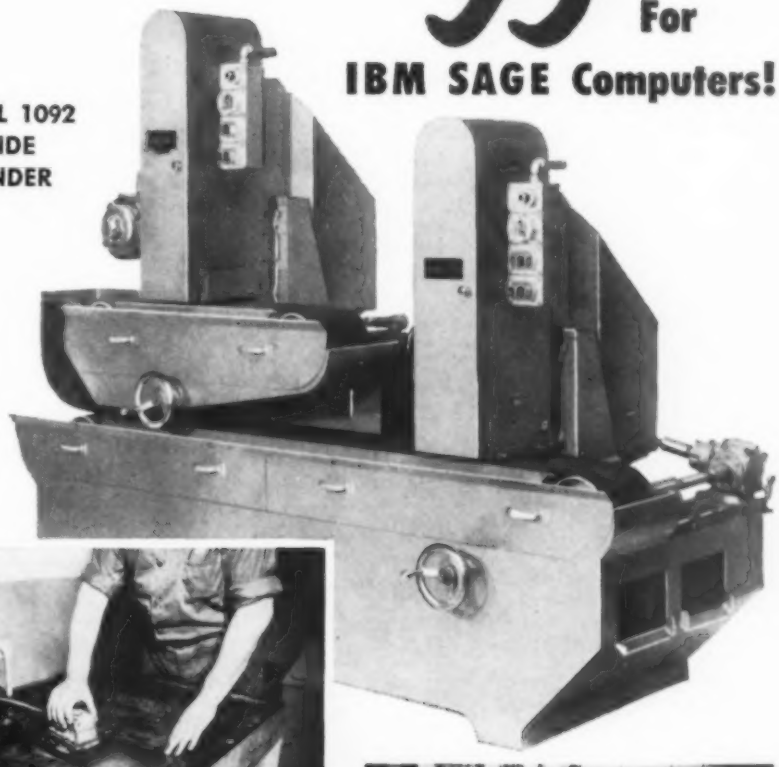
Use postpaid card. Circle No. 111



Microball micrometer height gage.

ENGELBERG Two-Side Grinder Cuts Printed Circuit Finishing Time by 93% For IBM SAGE Computers!

MODEL 1092 2-SIDE GRINDER



THE ORIGINAL OPERATION

An Engelberg conveyor-type abrasive belt grinder has multiplied production *by sixteen* – and virtually eliminated rejects – on a finishing operation at the Kingston, N. Y. plant (Military Products Division) of International Business Machines Corp.

Here the I.B.M. SAGE Computer is produced for the U.S. Air Force. To produce printed circuits for this computer, perforated phenolic sheets are copper clad on both sides, then coated with graphite. Excess graphite remaining on the two surfaces must then be removed.

Previously, the sheets were sanded under water by a pneumatic, oscillating hand sander. Sixteen man-hours were required to meet daily production.

Using a 240-grit belt, the Engelberg Model 1092 (described at right) removes .0001" on one pass . . . flips the sheet . . . removes .0001" from the other surface . . . all in a single cycle. The graphite coating remains only to coat the walls of the holes pierced in the part.

SOLUTION TO IBM'S PROBLEM: THE MODEL 1092 TWO-SIDE GRINDER

This high-production, semi-automatic abrasive belt machine gives precision finishing to close tolerances on both flat surfaces of *any* ferrous, nonferrous, plastic or other materials. Piece-work first passes under grinding head at left, then is carried around to bottom conveyor belt with unground face *up*, positioned for passage under second grinding head at right.

For complete information on this and other Engelberg Abrasive Belt Grinders consult your Sweet's Catalog or write . . .

The ENGELBERG-HULLER Co., Inc.
329 Seneca St., Syracuse, N.Y.

ENGELBERG PRECISION ABRASIVE-BELT GRINDERS

Use postpaid card. Circle No. 252

Toolmaker's Projector

A Toolmaker's Projector has been developed to meet need for economical tool room measuring operations. Uses for the new Toolmaker's Projector include checking circular form and single point tools; drill, tap, reamer inspection; screw machine part checking; gap setting and other micro adjustments; silicon and germanium wafer inspection; gear tooth form checking; thread form inspection.

Small tools or parts may be examined by sub-stage and surface illumination, showing clearly both contour and surface details. Unlike other optical instruments which use either a monocular eyepiece or ground glass, the Toolmaker's Projector utilizes an opaque photometric white 6″ x 6″ square screen situated at the rear of the instrument hood. Magnified, parallax-free images projected onto the screen are shielded from extraneous light and reflections.

Toolmaker's Projector for optical inspection.

A range of standard magnifications is available. Special magnifications and working distances can also be provided.

Stocker & Yale, Inc., Marblehead, Mass.

Use postpaid card. Circle No. 112

Height Gage

Standard Gage Company, Inc. has announced a Check Master height gage. The gage has a rigid 5/16″ x 1¼″ column supported by a cast iron base. The sliding carriage is extremely simple, but rigid with front of column free of lock or adjustment screws.

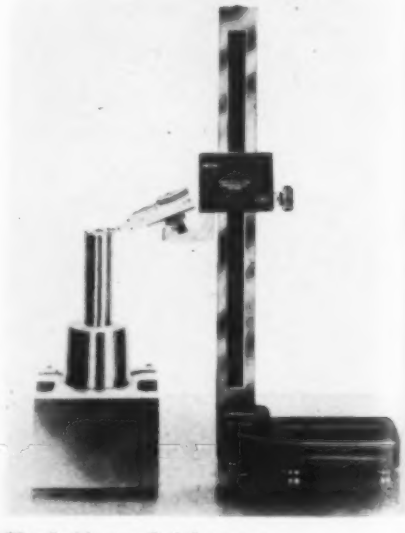
According to the manufacturer, desired height is easily set by a simple "lift" or "press" at point marked on the carriage. One finger pressure will raise or lower carriage to approximate desired setting—final "tenth" setting is then accomplished by turning fine adjustment screw at back next to the lift position.

Five hardened, ground and lapped rest pads are screwed into underside of base to assure maximum wear resistance and low friction action when moved on surface plate. According to Standard Gage this construction also eliminates error from air-cushion action common to ordinary flat bottom bases.

As base does not protrude beyond the column, maximum clearance is assured for close positioning. Tight coupling of gage is also provided so errors in indicator readings caused by overhang leverage are avoided.

Standard Gage Co., Inc., 557 Parker Ave., Poughkeepsie, N.Y.

Use postpaid card. Circle No. 113



Check Master height gage.

No. 4 *"Roughing it"* with Reddy MacFlint

Worth a fishing invitation? In sanding and polishing circular metal pieces with aluminum oxide cloth, the grain coating was weakened and the sheets left limp by many folds. A solution involving JEWEL BRAND ABRASIVES *cut costs 15%.*

"Smoothing the way where the going is rough"

AP salesmen know that there is a *certain flexibility* in coated abrasives that will work best on most operations. To determine it properly will result in better work at lowest cost.

Abrasive Products, Inc.

South Braintree 85, Mass.

MAKERS OF JEWEL COATED ABRASIVES

Use postpaid card. Circle No. 253

Electronic Comparator Has Self-Calibrating Circuit

A new type of electronic gage called the Versachek has been announced by the Instrument Gage Division of The Taft-Peirce Manufacturing Co., Woonsocket, R.I.

The Versachek converts minute differences in established dimensions into voltage changes and amplifies them for reading on a meter scale by means of electronic circuitry. A basic Versachek unit consists of electronic amplifier and pickup head, mounted on either a height gage stand or comparator stand. Gaging is accomplished by setting the Versachek gage head to a specific dimension by means of gage blocks or other suitable master and comparing actual product dimensions, reading the variance from the master on the meter scale.

The new Versachek is named for the extreme flexibility in selection of ranges. There are four magnifications available on the standard unit: 400:1, 2000:1, 4000:1, and 20000:1. These can be quickly selected by a switch on the front panel. Other magnifications can be furnished for special applications. In addition, the Taft-Peirce design is said to have five special advantages. The Versachek uses self-calibrating circuit which eliminates the need for constant reference to gage blocks.

There is unusually fast response, and connecting cables can be any length; complete unit can be set up quickly by a single reference to gage blocks or other master—zero is always the same; operation is foolproof, as accuracy is not affected by voltage fluctuations, and special pilot lights on the meter indicate the scale in use; and the Versachek is completely portable and can be universally adapted to other devices, such as ink recorders, oscilloscopes, and digital voltmeters.

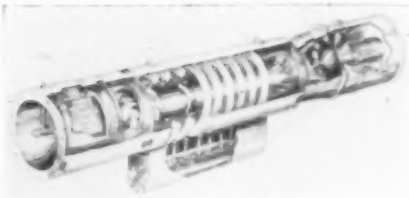
The Versachek is housed in a modern aluminum cabinet with handy controls and ready accessibility to the chassis. Overall dimensions are 9¼" wide x 7¾" deep x 8½" high and weight is only 13 lbs., plus required stand.

Taft-Peirce Mfg. Co., Woonsocket, R.I. •

Use postpaid card. Circle No. 114

"Miniaturized" Dust Collector

A new cylindrically-shaped wet type dust-collector said to be 1/20th to 1/10th the size of any comparable unit and capable of collecting over 99% of dust-particles 5 microns and larger in size, has been announced by Joy Manufacturing Company. Called the Joy Microdyne Dust-Collector, it is said to represent an unusual application of certain aspects of wet inertial type collection. Joy will produce the unit in a standard line ranging from 2500 cfm to 64,000 cfm. Special applications will be handled on a custom basis.



Joy Microdyne dust collector.

The Microdyne's size allows installation as part of the duct. The light weight collector can be supplied built of stainless steel at only slight extra cost. Joy believes the size and performance of this new dust-collector points to a wide range of use in industry.

Joy Mfg. Co., Oliver Bldg., Pittsburgh 22, Pa. •

Use postpaid card. Circle No. 115

WILTOMATIC AIR HYDRAULIC VISES, product of Wilton Tool Mfg. Co., eliminate wasted time and labor of manual clamping, speed production on bench operations. Assembly and testing, finish grinding, cut-off work and other jobs requiring frequent clamping and unclamping of work piece can be speeded considerably. Unit will open and close up to 2000 times/hour, at touch of a foot pedal air control. Maximum jaw locking force varies between 2513 lbs. to 6891 lbs. Wilton Tool Mfg. Co., Inc., Schiller Park, Ill.

Use postpaid card. Circle No. 116

Campbell
Abrasive Cutting Machines

Abrasive Cutting Know-How

Know-How is just as vital to top performance in abrasive cutting as in any other machine tool operation

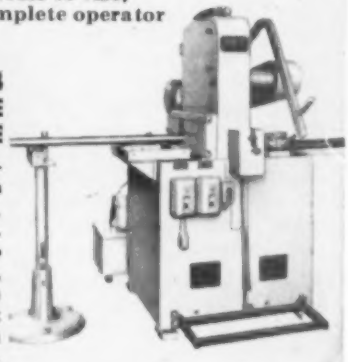
These Campbell Abrasive Cutting Machines are Ideal for Job Shops

CAMPBELL #28 DRY CUTTING MACHINE

You can cut up to 4" square solids, 6" angles, 8" channels, and 4" diameter tubing. Wheel-oscillation permits cutting of large sections without burn—at a rate of 2 to 5 seconds per square inch. "Swing-away" wheel guard permits unobstructed access to vise, but provides complete operator protection.

CAMPBELL #64 WET ABRASIVE CUTTING MACHINE

You'll get accurate, burn-free cuts because of CAMPBELL's ideal coolant application, wheel guides, wheel oscillation, and ample power. A versatile vise firmly holds all shapes up to 3" diameter steel bars, 4" diameter tubing, and 6" x 1" plate—for cuts at the rate of 6 to 10 seconds per square inch. A quick setting work-stop swings with the vise for angle cuts to 45°.



ABRASIVE CUTTING OFFERS YOU—

Versatility • Single piece of equipment cuts tool steel, structurals, tubing, heat-resistant alloys, and new "wonder metals," with quality and accuracy.

Economy • High production rates, negligible set-up time, elimination or reduction of annealing and deburring reduce labor costs —save production space.

For further information write for the illustrated Bulletin DH-460-B

ACCO

CAMPBELL MACHINE DIVISION • American Chain & Cable

926 Connecticut Avenue, Bridgeport 2, Connecticut

Use postpaid card. Circle No. 254

Drill Grinder for Small Diameter Work

Jemco announces the new model SM-3 Drill Grinding Machine for drills 0.012″ to 0.120″.

Handling of this machine is said to be sufficiently simple so that no difficulty in producing perfect sharpening is encountered even by the unskilled. The drill is simply clamped into holder which accommodates the machine's complete diameter range and checked under microscope. Shape of the holder assures symmetrical sharpening of drill regardless of the predetermined tip angle, backing off angle or whether they are right or left hand drills. Wheel dressing is also simplified. Built into the machine is a wheel truing attachment operated by controlling the oscillation motion of the guard.

Jersey Mfg. Co., 436 Livingston St., Elizabeth, N.J.

Use postpaid card. Circle No. 117

Jemco drill sharpener.

Air-Operated Cutoff Machine

As many as 2,000 pieces of pipes and tubes ranging in size from ⅜″ to 1¼″ O.D. in light gauge to 16-gauge wall thickness, can be cut per hour on a new air-operated rotary cut-off machine, according to the manufacturer, Continental Machine Co.

The operator simply feeds the pipe or tube to a pre-set stop, touches the air valve foot switch and the rotary blade descends at the desired cutting speed, cutting the material and leaving a clean, smooth edge.

Rotary cutting is said to provide faster cutting than other methods since its action is through the wall thickness rather than the entire diameter of the material.

This, plus the automaticity of the air operation eliminates operator fatigue, permitting steady, high production rates. For intermittent use, a handle can be attached for manual operation. Adjustable pipe and tube support tables are available with nylon fork rollers to minimize scoring of material.

Continental Machine Co., 1952 N. Maud Ave., Chicago 14, Ill.

Use postpaid card. Circle No. 118

Cutoff machine for light-gage tubing.

FOR LOWER SNAGGING COSTS

ATLANTIC

"Job-Mated"

GRINDING WHEELS

Time and again snagging costs have been reduced by the following ATLANTIC ABRASIVE formula: (1) a thorough analysis of specific snagging operations; (2) "mating" the grinding wheel characteristics to the job requirements. Equally important . . . ATLANTIC ABRASIVE representatives thoroughly understand the factors involved in snagging operations such as the structural differences in metals, even in the same metal; the quantity of stock to be removed; and the most effective combination of such factors' requirements to produce the desired results.

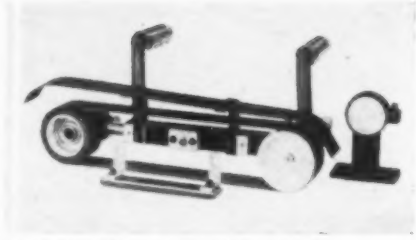
RESULTS Because ATLANTIC Resinoid-Bonded GRINDING WHEELS are "job-mated," they have a smooth, floating action that requires less pressure, thereby reducing operator fatigue, and they cut cleaner, faster and run cooler on job after job . . . reducing costs to a minimum. Prove it for yourself. Call your nearby ATLANTIC representative or write direct. Atlantic Abrasive Corp., 532 Pearl St., South Braintree, Mass.

A complete line: everything you need for roughing, finishing, and polishing including mounted wheels and points and depressed center wheels.

ATLANTIC ABRASIVE CORP.

South Braintree 85, Massachusetts

Use postpaid card. Circle No. 255



Model 2-42 portable belt grinder.

Portable Belt Grinder

Model 2-42 Abrasive Belt Grinder is designed for portable or fixed bench mounting. The unit will handle any grade grit of aluminum oxide or silicone carbide abrasive in 2 inch wide belts.

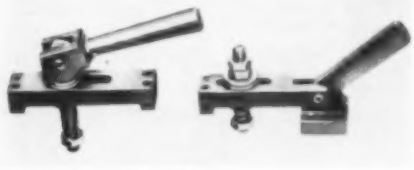
Used as a portable hand unit, the flexibility of the belt permits grinding of convex or flat surfaces. A belt support accessory may be attached to give added rigidity to the belt on flat grinding. Handles may be reversed for over or under the work grinding or for right or left hand operation. Six different handle adjustment combinations can be made.

The grinder's frame is cast aluminum alloy. It is powered with a 1½ horsepower air motor which gives the belt a surface speed of 6000 feet per minute. The unit complete weighs 9 pounds 4 ounces.

When the efficiency of the abrasive has been reduced by wear, replacement is made by pressure against the spring-loaded idler wheel assembly, releasing and replacing the old belt.

Abrasive Machinery Corp., Dept. 478, 444 S. Pennsylvania St., Indianapolis 4, Ind. •

Use postpaid card. Circle No. 119



Strap clamp assemblies.

Strap Clamp Assemblies

A new principle in strap clamping which gives secure, safe clamping of all work—rough, finished, irregular surfaces—has been developed by Jergens Tool Specialty Co.

These new strap clamping assemblies feature a universal-type, highly maneuverable strap milled from solid stock and available with 5 interchangeable pads of soft stock. The pads can be formed for perfect fit on any shape work surface and offer secure downward pressure. According to the manufacturer, these new clamp assemblies cut costs, manhours, and speed-up production because they eliminate long, costly set-ups, insecure clamping, and marred work surfaces due to excessive clamping pressure. Pads are attached to strap by two screws and are easily and quickly interchangeable. Brass or bronze pads can be used for extra soft work.

Jergens Strap Clamp Assemblies are available from watchmakers' sizes to assemblies large enough to hold big machine tool jobs. Wide range of designs includes a variety of nut and bolt type assemblies for heavy-duty work to cam-types for fast-change, light holding.

Jergens Tool Specialty Co., 712 East 163 St., Cleveland 10, Ohio. •

Use postpaid card. Circle No. 120

Right-Angle Portable Grinder

Vee-Arc Corp., Westboro, Mass., announces a new 2 horsepower portable right-angle head grinder designed for use with 9-inch disc wheels. Suitable for heavy-duty snagging and weld removal, the Model H is said to function on about 60% power for typical weld grinding jobs. No-load speed is 5300 rpm, net weight is 14 pounds. Standard equipment includes 4-inch metal support plate with nut and wrench. 10-foot heavy duty power cable, reversible side handle. Features include Marlin-Rockwell sealed ball bearings throughout, automatic reset overload protector, and 10 hp rated matched spiral bevel drive gears.

Vee-Arc Corp., Westboro, Mass. •

Use postpaid card. Circle No. 121

R. G. haskins Co.

FLEXIBLE SHAFT MACHINES

faster

Haskins machines will speed production on a big variety of metal-working jobs with their continuous speed and unerring performance. And there's no need to worry about changing tools—it takes just seconds to switch to any one of the numerous metal-working attachments in the Haskins line. *Use Haskins equipment and eliminate interruptions.*

easier

Haskins flexible shaft machines make the whole operation a simple matter. They're portable—ready to go to work in whatever spot you choose, even remote sections of your plant. Operators say Haskins machines are easy to use because they have to hold only the lightweight handpiece which permits greater accuracy for close, precision work. You should know about Haskins flexible shaft machines and accessories-*leaders in their field for over 30 years.*

HASKINS

Write Today for a Catalog and Literature

R. G. HASKINS Co.

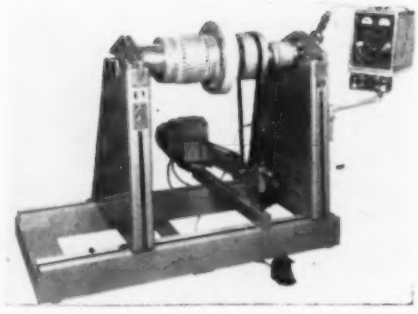
2649 West Harrison Street Chicago 12, Illinois

Use postpaid card. Circle No. 256

Dynamic Balancers

New line of dynamic balancing machines used to correct vibration and unbalance problems has been announced by International Research and Development Corp.

New balancing machines are (1) used for dynamic and single plane balancing of motors, spindles, turbines, impellers, flywheels, blowers, and the like. Yet the electronic console of the balancing machine is readily disconnected for portable use, (2) to check vibration tolerances of assembled machinery, (3) to pinpoint the causes and analyze all frequencies of vibrations in assembled machinery, and (4) for "in-place" or portable balancing.



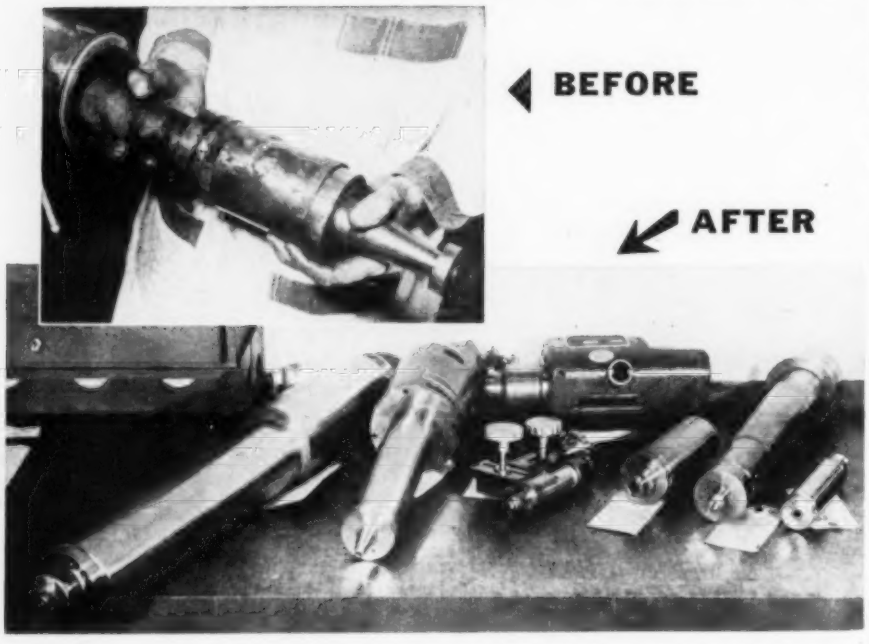
IRD dynamic balancing machine.

The electronic console of the balancing machine consists of any of the various models of portable IRD Vibrations Analyzers. Angle of unbalance is observed on the workpiece under a brilliant white stroboscopic light. Amount of unbalance is observed directly on a meter of the analyzer. Two adjustable workpiece supports contain dynamic pickups to convert the transverse motion of the workpiece to electrical signals. The workpiece is belt-driven from an electric motor through a jackshaft to control belt tension. Workpiece may be mounted either between bearing supports or in an outboard manner.

International Research and Development Corp., 797 Thomas Lane, Columbus, Ohio. •

Use postpaid card. Circle No. 122

BEARINGS, INC.
SPINDLE REPAIR SERVICE



All types and makes of High Speed Internal and External Grinder Spindles and Quills . . . Anti-Friction Live Centers . . . .

Restored to Original Accuracy in HOURS . . . Not Weeks!

Gentlemen:
I'd like to have complete information on your spindle repair service.

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WEST VIRGINIA: Charleston • Huntington • Wheeling
NEW JERSEY: Camden • MARYLAND: Baltimore
DELAWARE: Wilmington •
Subsidiaries: Bearings Corp. • Buffalo, N. Y. •

Use postpaid card. Circle No. 257

Midget Die Grinders

Two new Midget pneumatic die grinders for use in intricate precision grinding, filing and cutting jobs have been developed by the Airetool Mfg. Company, Springfield, Ohio.

Both the model 200 and 300 midget pneumatic die grinders are designed to combine speed with accuracy. The model 200 grinder operates at speeds up to 60,000 RPM and weighs only 4 ounces. Length of the unit is 4⅞" with a diameter of ⅜", and it has a ⅛" Collet chuck. Airetool's model 300 operates at speeds up to 38,000 RPM and weighs 12 ounces. Length of this grinder is 5¾" and it has a diameter of 1-1/16". This model is equipped with a ¼" and a ⅛" Collet chuck.

Push type throttle is conveniently located for instant and accurate speed control. Grinders should be connected to an air line that has a fog type lubricator-filter available as an accessory part.

Airetool Mfg. Co., 328 S. Center St., Springfield, Ohio. •

Use postpaid card. Circle No. 123

Airetool's Model 200 midget pneumatic die grinder.

Improved perforator grinding fixture.

Harig Announces Improved Grind-All

Harig Mfg. Corp. announces an improved Grind-All fixture for perforator grinding.

The fixture easily grinds irregular shaped perforators concentric with shank within ± .0002 accuracy. It can also be used for light milling and boring, radius dressing and as an inspection tool. Harig says the advantages of the new design are: 1) Hand crank for easy rotation of index plate—simplifies all grinding operations, especially those requiring continuous revolution. 2) Single locking screw—adjusts V-Block to any desired position, replaces former design which required 6 locking screws. 3) Leatherette carrying and storage case—protects the instrument and is furnished with each fixture.

Harig Mfg. Corp., 5757 W. Howard St., Chicago 31, Ill. •

Use postpaid card. Circle No. 124

"CONTROLLER" CALCULATOR is circular slide rule device for commercial and technical calculations, said to be world's smallest. All aluminum construction, 3 inches diameter, with performance of a 10-inch slide rule. Price $7.95 each, less with quantity orders. Silver Bells Ltd., 600 - 16th St., Oakland, Calif.

Use postpaid card. Circle No. 125

Grinders Feature Power, Lightweight Construction

Latest in the Cleco line of pneumatic hand tools are the new 1500 Series grinders. Designed for use in a variety of metal grinding, sanding and wire-brushing operations, the design of these new air tools has been thoroughly tested in use.

In addition to claimed advantages of air tools over other types of power hand tools—low maintenance, long life and simplicity of overhaul—these have exceptionally lightweight construction through use of magnesium alloy castings. Lever-type thumb-tip throttle provides effortless control of the tool without changing grip. Muffler handle reduces noise and serves as an air exhaust, eliminating unnecessary holes in the grinder casing and preventing entry of harmful particles.

Cleco air grinder.

The basic tool is available in a variety of speeds and for several different wheel and guard mountings to meet virtually every type of grinding, sanding and brushing requirement.

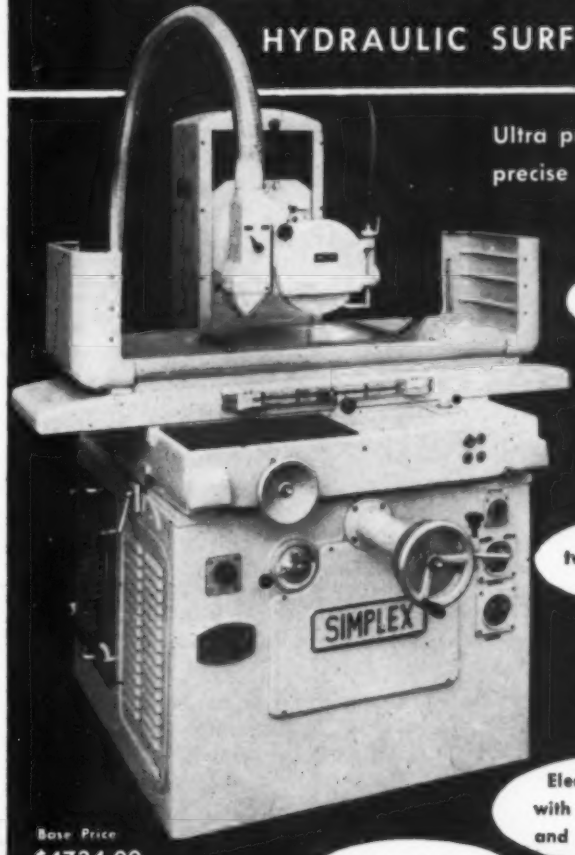
Cleco Air Tool Div., Reed Roller Bit Co., 5125 Clinton Dr., Houston 20, Tex. •

Use postpaid card. Circle No. 126

BLOHM SIMPLEX

HYDRAULIC SURFACE GRINDER

Ultra precision for your most precise grinding requirements



12" x 20" grinding surface

15" spindle to table top

5½ H.P. two speed wheel spindle

Utilizes 2" x 10" wheel

Electric cross feed with automatic return and rapid movement

Table rides on ball bearings

Base Price $4734.00 including built-in combination exhaust and coolant systems.

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46 SEA CLIFF AVENUE

GLEN COVE, L. I., N. Y.

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Controller Regulates Grinder's AC Motor Speed

A new means of speed regulating a standard wound-rotor AC motor is now available from Warren Mfg. Co., Littleton, Mass. The company states that with its Type 2027 variable-speed controller, close speed regulation with a conventional off-the-shelf-type AC motor is obtained over a wide speed range. Full rated motor torque is achieved at all speeds without exceeding rated rotor or stator currents. Using a DC tachometer generator for feedback of motor speed, regulation of ± 1% over a speed range of 1050 to 1530 rpm is obtained via power magnetic amplifiers in series with rotor-circuit resistors.

The Warren 2027 variable speed controller was first installed over a year ago in a machine tool application where it has been used to regulate the speed of an 11 HP wound-rotor motor. This AC motor is directly coupled to an AC generator whose output frequency controls the speed of a squirrel-cage grinding machine motor. Grinder speed is controlled by regulating the generator drive hence the generator frequency output. This frequency accuracy is maintained at ± 1% from no load to full load over a generator frequency range of 44 to 61 cycles and with line voltage variations of ± 10%.

Warren Mfg. Co., Inc., Littleton, Mass. •

Use postpaid card. Circle No. 127

Warren AC motor speed controller.

ROTARY TABLE PILOTOR expands use of Profilometer line to include measurement of surface roughness of concentric diameters on flat surfaces. Typical applications for pilotor include measurement of refrigerator seals and valve seats. Micrometrical Mfg. Co., 345 S. Main St., Ann Arbor, Mich.

Use postpaid card. Circle No. 128

DESIGN OF KIDDE'S new 20 and 30 lb. dry chemical extinguishers (20 lb. illustrated) makes operation of the units self-evident for anyone picking up a unit in a fire emergency. Simply aim the discharge horn at the fire and pull the trigger. Walter Kidde & Co., Inc., Belleville, N.J.

Use postpaid card. Circle No. 129

Allison
Abrasive Cutting Wheels

Abrasive Cutting Know-How

Know-How is just as vital to top performance in abrasive cutting as in any other machine tool operation

VERSATILITY and SPEED MAKE ABRASIVE CUTTING IDEAL for JOB SHOPS

Are These Your Problems?

Frequent Short Production Runs! • Did you cut stainless steel tubing and high speed tool steel yesterday—and must you cut structurals and flat stock today?

Varied Quality Requirements! • Is burr or burn acceptable on your structurals, but intolerable on tubing and solid bar stock?

• Abrasive cutting is the fast, economical answer to these cut-off problems. All of the above materials can be cut with equal ease, abrasively—at the rate of 2 to 5 seconds per square inch cutting dry, or 6 to 10 seconds per square inch cutting wet on sections up to 12 inches square.

An ALLISON field engineer can recommend the ALLISON abrasive cutting wheel to give you the best combination of economy and quality for the entire range of your materials. Use of such an *individually selected* all-purpose abrasive cutting wheel will keep your set-up time to an absolute minimum.

***For more complete information** write for this helpful booklet—*
ABRASIVE CUTTING BY ALLISON

ACCO

ALLISON DIVISION • American Chain & Cable

254-F Island Brook Avenue, Bridgeport 8, Conn.

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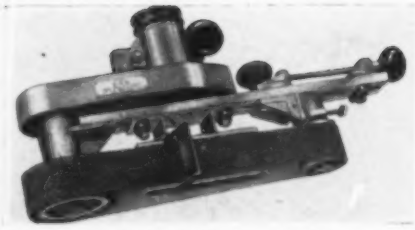


B & E contact wheel belt grinder.

Contact Wheel Belt Grinder

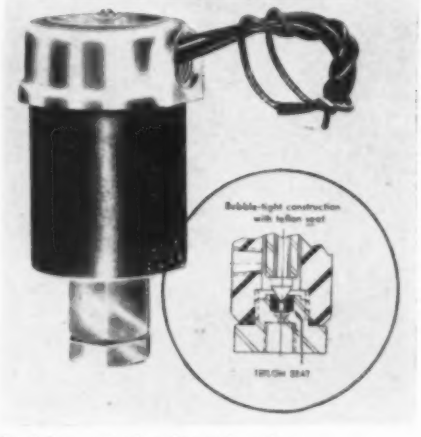
Addition of two new models of belt grinders including Model 400, with a 5-inch x 2-inch contact wheel and 2-inch x 48-inch abrasive belt; Model 300, a 4-inch x 2-inch contact wheel and 2-inch x 36-inch abrasive belt.

Construction of the B & E contact-wheel belt grinders permits a 360-degree rotation of the contact wheel, allowing easy, instant adjustment to the working position of any operator. This eliminates uncomfortable positions for the operator and results in faster production.

Any one of the B & E grinders can be mounted on a portable table, bench, or pillar. Only 4 bolts are required. The uniform speed of the belt gives smooth, even finish.

B & E Mfg. Co., Inc., Oak Grove, Mo. •

Use postpaid card. Circle No. 130



Stainless steel solenoid valve.

Stainless Steel Solenoid Valve

A solenoid valve said to be bubble tight even at 5,000 psi working pressure is now available from Atkomatic Valve Company, Inc. Designated Type SBTDW, the valve is a small, direct lift, angle type machined from 316 stainless steel bar stock. This construction provides exceptional corrosion resistance.

A newly designed Teflon seat eliminates metal-to-metal seal and assures bubble-tight operation even with such elusive gases as helium, nitrogen and carbon dioxide. Can be used over a wide temperature range.

Atkomatic Valve Co., Inc., 545 West Abbott St., Indianapolis 25, Ind. •

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the BIG difference in DIAMOND WHEELS

BOND... the big reason why diamond wheels by J. K. Smit meet your requirements

EXPERIENCE... gained from many years of testing cementing mediums and fillers

QUALITY CONTROL... that insures even distribution of diamond particles throughout every wheel

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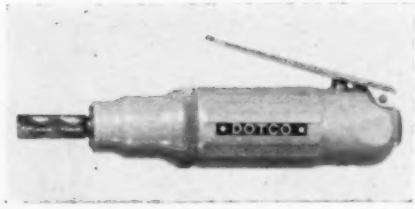
Pneumatic Die Grinders

A new line of Dotco rotary vane type pneumatic die grinders is announced by Doeden Tool Corporation, Sherwood, Ohio.

Specifically designed for contour finishing and grinding of dies, molds, patterns, forgings and castings, it is also used advantageously for deburring machined parts.

The unit is designated as Dotco Model 1GL with lever control, or Dotco Model 1GB with optional button control. Both units are used with carbide burrs, ½" and smaller diameter, ¾" diameter vitrified and 1" diameter organic wheels, or with flexible disc holder for sanding discs up to 1½" diameter. The unit is equipped with an Erickson Precision Collet Chuck using Erickson 300 series collets.



Dotco Model 1GL pneumatic die grinder is furnished standard with long or short collet guard, as specified.

The manufacturer claims several advantages for the Dotco four-vane rotary air motor design over turbine driven air tools. Among these are greater torque and horsepower in a smaller, lighter, more compact package. In addition, the unit runs cool at its free speed of 30,000 rpm and is positive starting.

The Dotco die grinder's vibration-free power reduces operator fatigue, lengthens tool life and reduces maintenance, according to the manufacturer. Other features contributing to longer life are sealed front ball bearing, and truer operation with guaranteed TIR of .0005".

Dotco pneumatic die grinders, Models 1GB and 1GL, weigh 12 ozs. They measure 21/32" from the center of the spindle to the side of the tool and have an overall length of 4-23/32".

Doeden Tool Corporation, Sherwood, Ohio. •

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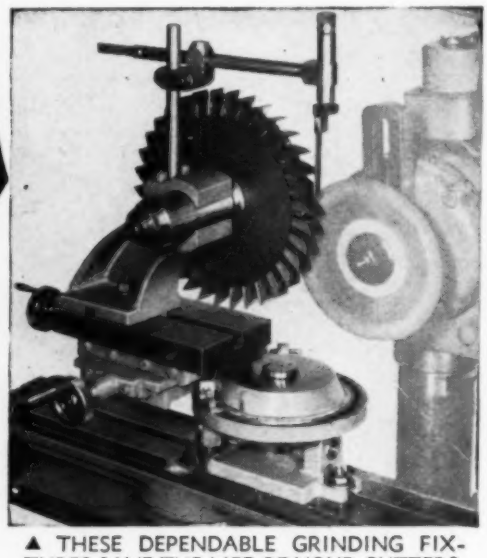
THE UNIVERSAL RADIAL CUTTER GRINDING FIXTURE

Does 5 Operations without removing cutter from its ARBOR!

On cutters up to 8" in diameter, the No. 6 fixture, as shown with our No. 6A heavy-duty, right-angle, ballbearing spindle workhead:
Sharpens side teeth on **both** sides.
Sharpens peripheral teeth.
Generates small or large radii on **both** corners of each tooth.
(Other workheads available)

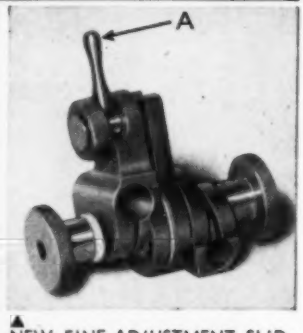


▲ THESE DEPENDABLE GRINDING FIXTURES SAVE THE LIFE OF YOUR CUTTERS. Write for our catalog 603

◀ UNIT 1A
This Universal Cutter Grinding Fixture fits any universal tool or surface grinder.

Radial Grinding Attachment D combines with Unit 1A for sharpening end mills with square, conical, or ball nose shapes. ▼

▲ UNIT 4A
Radial Grinding Fixture for sharpening fluted end mills with square, conical, or ball-nose mills. The index disc provides for multi-flute cutters.



▲ NEW FINE-ADJUSTMENT SLIDING SWIVEL GIVES SMOOTH, PRECISE INDICATOR SETTING. Smooth, positive positioning of finest dial indicator is readily accomplished by the fine-adjustment Sliding Swivel. Final precise positioning is accurately made by slight movement of convenient lever "A".
WRITE FOR:
SLIDING SWIVEL FOLDER

ROCHELEAU TOOL & DIE CO.
650 North Main St., Leominster 1, Mass.

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Multi-Lamp can be quickly moved from one location to another.

Work Lamp

Multi-Lamp, a new type light for industrial use, is instantly movable from one work area to another as the result of a quick-coupler mechanism built into the base, simple movement of which locks the light on a small mounting bracket.

In addition to mobility, it features a cool shade, an industrial type switch covered by a 5-year warranty, polyvinyl protection of the arm to assure lasting rigid flexibility, recessed bulb mounting to eliminate eye glare, a 360° ball bearing swivel base, and an inner aluminum reflector treatment that provides maximum light reflection.

Moffatt Products, Inc., 4824 Triton Drive, Minneapolis 22, Minn. •

Use postpaid card. Circle No. 133

Sunnen mechanical comparator.

Precision Gage Announced by Sunnen

The Sunnen PG-800 Precision Gage recently introduced at the Quality Control Show in Detroit is said to represent a new method of precision-measuring internal diameters. The portable comparator-type gage is entirely mechanical.

It covers a size range from ⅜" to 1½" dia., and has a reading scale of .005", calibrated in 50 millionths graduations. Accuracy is within 20 millionths of an inch. Magnification is 1000:1. Scale is linear over full range. The gage can be set quickly and accurately to any desired size, and is instant reading. A movable face plate allows full exploration of holes up to 3-5/16" max. depth.

The gage is entirely self-contained, requiring no air or electric connectors. It is intended for everyday use in the production shop and in the inspection department. Available on a "use-lease" plan, an annual fee for the gage includes all service and maintenance costs.

Sunnen Service Corp., 7900 Manchester Ave., St. Louis 17, Mo. •

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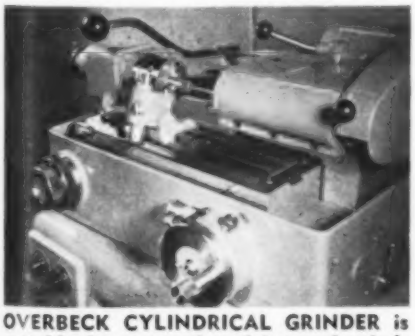

OVERBECK CYLINDRICAL GRINDER is suitable for external and internal grinding of all types of components. Capacity ranges from the smallest diameter to a maximum grinding length of 4¾"; the maximum length of the component which can be accommodated is 8⅜". Bearings are adjustable and self-lubricating. Movement of the table is effected by special drive which gives uniform speed of stroke with accelerated reversal at end of stroke. The length of stroke can be adjusted from 0.004" to 4¾". Infeed of grinding wheel is automatic and adjustable from 0.00002" per stroke or double stroke. Automatic fine-adjustment cross-feed, with adjustable stop for finish sizing. Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N.Y.

Use postpaid card. Circle No. 135

Washer for Heat Treat Lines

A new washer for removing oil from work before and after heat-treating or for general utility cleaning operations has been developed by Eclipse Fuel Engineering Co., Rockford, Illinois. It can work in conjunction with heat-treat systems and may be used either in an integrated, continuous line or as an individual unit serving a number of heat-treating furnaces.

The new washer uses either hot caustic or detergent to remove oil, dirt, etc., and has a work area 24" wide, 36" long, and 18" high. Two basic models are available: (1) Double-end design that is loaded at the front and unloaded at the back, and (2) in-and-out type unit that is loaded and unloaded through the same opening. The hooded solution tank has a capacity of 300 gallons and is equipped with an overflow trough and a drain valve.

Eclipse Fuel Engineering Co., 1100 Buchanan St., Rockford, Ill. •

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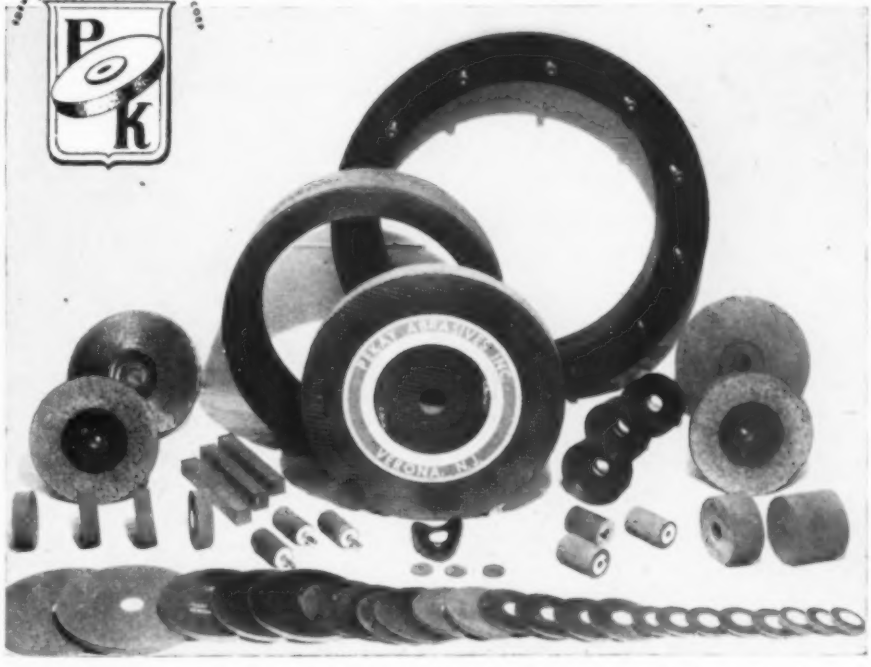
A complete line of custom Abrasives



Are you grinding with 1957 model grinding wheels or just letting the old "metal burner" do?

Let us show you what real wheel development is. For example, a flexible rubber bonded wheel that operates safely at 16,000 f.p.m.

Let Pekay show you the way.

Send For Complete Information.

PEKAY ABRASIVES, INC.

271 GROVE AVENUE VERONA, NEW JERSEY

CENTER 9-4600-1

Use postpaid card. Circle No. 262

Compound Aids in Stripping of Plating

Buffing and polishing of plated rejects are facilitated with a new flaky, light organic compound, Iso-Strip, developed by Wagner Bros., Inc., Detroit, for chemical stripping operations.

The compound, when combined with sodium cyanide and dissolved in water, will strip plated deposits from ferrous-base metals without the use of electrical current. It removes copper, nickel, cadmium, zinc as well as silver, size of the part in no way hindering results.

Wagner Bros., Inc., 400 Midland Ave., Detroit 3, Mich. •

Use postpaid card. Circle No. 137

Monochromatic Light for Checking Surface Flatness

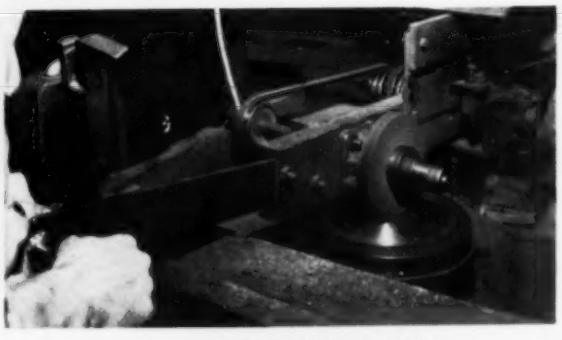
A new monochromatic light for measuring flatness has been introduced by the Lapmaster Division of Crane Packing Co. New light is four times larger than the present model, 11" x 14" with a work stage size of 10" square. Heavy duty, 9,000-volt transformer provides an average of 40 foot candle power at diffusing glass. The light head may be tilted back and adjusted for height to permit maximum light on check area. On pieces too large for the work stage to hold, the light head may be swung completely around to permit checking work right on bench. This portable unit, using optical flats is said to offer the most accurate method of checking and inspecting surface flatness on lapped parts of any size.

Crane monochromatic light.

Crane Packing Co., Dept. GFN, 6400 Oakton St., Morton Grove, Ill. •

Use postpaid card. Circle No. 138

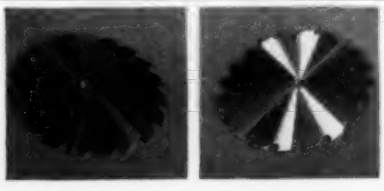
FOR HEINEMANN SAWS—



how HEINEMANN does it!

Saw blades are taken rough ground from surface grinders. They are placed on the magnetic rotating plate. The Brightboy Wheel oscillates back and forth across the surface of the saw.

"a mirror-like BRIGHTBOY Finish, unobtainable by any other form of polishing"



BEFORE AFTER

Heinemann Saw before and after Brightboy polish.

The FINISHING Touch!

"The eye-appeal provided by Brightboy's unique working action plays an important part in selling our saws", says Mr. William Heinemann of nationally-known Heinemann Saw Corporation, Canton, Ohio. "It produces the superb finish which reflects the high skill of our craftsmen and our use of finest materials."

FOR MANUFACTURE & MAINTENANCE OF MANY TYPES OF TOOLS

A Single-Step BURRING, FINISHING, CLEANING, POLISHING OPERATION

Brightboy's ABRASIVE & RUBBER work simultaneously to achieve this 4-in-1 operation. Stock Brightboy numbers are match-mated to the tool and steel for any requirement of finishing. A Brightboy finish frequently constitutes the final polish.

Readily Available: A WIDE RANGE OF STOCK BRIGHTBOY SHAPES, SIZES & TEXTURES

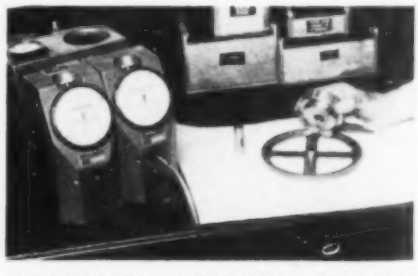
Wheels, sticks, rods and blocks for machine and manual operations come in Silicon Carbide and Aluminum Oxide grains from extra fine to extra coarse. Soft, firm, and tough rubber binders.

Practically limitless applications bring an entirely new, wider concept of abrasive uses. Ask your dealer for Brightboy's catalog listing grains, textures, applications, machine speeds. Write us if he cannot supply you or on any problem in which finishing is involved.

WELDON ROBERTS Brightboy RUBBER CUSHIONED ABRASIVES

BRIGHTBOY INDUSTRIAL DIVISION
WELDON ROBERTS RUBBER CO.
95 North 13th Street Newark 7, N.J.
America's Pioneer Manufacturer of Rubber-Bonded Abrasives

Use postpaid card. Circle No. 263



AIR RING SOLVES PRECISION PROBLEM —Shape and small size of this gear allowed micrometers to measure only the outer portion of the hub O.D. But required precision of the part demanded that the O.D. dimension along the entire hub be checked. The gear is used on the Man-Au-Trol bracket of the Bullard vertical turret lathe. A specially designed air ring solved the problem. The ring fits over the hub, has a pair of measuring air jets close to the bottom of the bore. By raising or lowering the ring, the operator now can speedily measure the O.D. anywhere on the hub to 0.0001 inch. The ring is connected to an air gage manufactured by Federal Products Corp., Providence, R.I.

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News of Industry

Grinding Wheels Featured in Pittsburgh Meeting

A five session program on grinding wheels will be presented at Carnegie Tech. commencing at 7:30 P.M. Monday, October 7, 1957. This is a continuation of the educational clinic sponsored by the Pittsburgh ASTE chapter which, to date, has included technical discussions on carbides and tool steels. The first meeting will deal with manufacturing (quality control points) and safety—to be handled by the Simonds Abrasive Co. and Grinding Wheel Institute personnel, respectively.

The second meeting, October 14th, will be presented by The Carborundum Co., and will concentrate on vitrified bonded (low speed) type wheels. On October 21st, Bay State Abrasive Products Co. personnel will discuss resinoid or organic (high speed) bonded wheels.

October 28th will have as its featured topic diamond wheels, to be delivered by The Norton Co. personnel.

Some of the top technical and practical men in the field will be on hand for these presentations.

Registration fee for the five day session is $2 for regular members and $5 for non-members. Those wishing to attend may contact any local member or Mr. Walter E. Baker, Jr., Chairman Educational Committee, c/o Universal Cyclops Steel Corp., 507 Grant Building, Pittsburgh 19, Pa. •

THE LAMINAGAGE measures as little as one ten-thousandth of an inch of paint film, electroplating or metal overlay. Here it is being tested by General Motors research staff, left to right, Eugene A. Hanysz, Dr. Roger L. Saur, and Clark E. Quinn, who is moving the instrument's probe on a bearing surface overlay. The overlay thickness measurement is registered on the instrument's gage. The Laminagage is now being used as a quality control instrument in two General Motors divisions.

Company Briefs

Chance Vought Aircraft has been awarded a $35,000,000 Navy contract for the continued development of a carrier-based interceptor to be powered by a Pratt & Whitney J-75 engine and to be known as the F8U-3.

Standard Pressed Steel Co. has set up a Precision Stud Division, a separate manufacturing and sales division to meet the growing needs of conventional and nuclear power plant builders for special stud-type fasteners.

Black & Decker Manufacturing Co. has announced the opening of a new factory service and sales branch in Hartford, Connecticut, serving users in an area extending as far as Springfield, Massachusetts, and New Haven, Connecticut.

Murray-Way Corporation, Birmingham, Michigan, has appointed as distributor **Giebel, Inc.** of New York and New Haven.

Firth Sterling Inc. is now accepting orders for induction vacuum melted super alloys. Kolcast Industries Inc., a subsidiary of Thompson Products Inc., is now producing super alloy ingots for Firth Sterling, as a result of a joint venture agreement early this year. Ingots weighing 500 lbs. are currently

being produced in Waspalloy, M-308, and René 41 which are converted by Firth Sterling, at their McKeesport, Pa. plant, into billets, centerless ground and hot rolled bars. In the near future, Kolcast will provide ingots up to 2,500 lbs. in a variety of critical super alloys.

Minneapolis-Honeywell Regulator Co. has opened a new $1.5-million plant for the production of industrial valves for automation and the nation's expanding missile program in Fort Washington, Pa.

Production Tool Company, Cleveland, has been appointed sales representative in northern Ohio for Taft-Peirce Manufacturing Co. of Woonsocket, R.I.

Electro Refractories & Abrasives Corp., Buffalo, will exhibit its products, including grinding wheels, special refractories and crucibles at two important fairs in August and September. The company will exhibit in the Erie County Fair, Hamburg, N.Y., Aug. 17-24 and then will move to Syracuse for the New York State Fair Aug. 30 to Sept. 7.

Firth Sterling Inc. has announced a 4% increase on high temperature alloy base prices, effective Tuesday, July 16, 1957. Stainless steel extras, which also apply to high temperature alloys, were increased by the same percentage July 11, 1957.

WORKMEN AT Watervliet Works of Allegheny Ludlum Steel Corporation guide a copper crucible into the company's new consumable electrode vacuum melting furnace. The crucible serves as the mold for an ingot of super-alloy. The new furnace is capable of producing ingots 26-inches in diameter and weighing up to 12,000 pounds.

To meet increased demand for its product line and streamline its service organization, **Weller Electric Corporation,** Easton, Pa., manufacturer of soldering guns and other electric power tools, will centralize all production, sales and administrative operations in the U.S. at its present general offices in Easton. New facilities will be erected later this year to quadruple the space of the present 12,000 sq. ft. building on a five-acre tract.

Occupancy of a new office and warehouse building by **American Chain & Cable Company, Inc.,** in the Central Manufacturing District of Los Angeles, Cal., has been announced.

Personnel Briefs

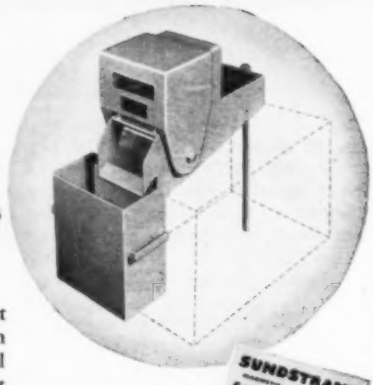
Robert C. Wright has been promoted to chief of production engineering at Pratt & Whitney Aircraft, East Hartford, Conn. Wright had responsibility for process planning for the J-57 jet engine.

John J. Wagner has been appointed Indiana sales representative for the grinding wheel division of Electro Refractories & Abrasives Corp., Buffalo.

$1927.12 SAVED PER YEAR

...with Sundstrand Magnetic Coolant Separator

Installation of a Sundstrand Magnetic Coolant Separator on a grinder, as shown above, resulted in a yearly saving of $1927.12. Further, instead of cleaning the coolant tank twice daily, it now requires cleaning only *twice weekly.* Cost of the installation is approximately $495.00. The unit requires no attention and little or no maintenance.



Easily Installed Without Additional Piping

An important feature of this magnetic coolant separator is that it can be dropped into position on most open type coolant tanks. No additional piping is required. Install one on your present equipment and compare its efficient operation with other units.

Free Additional Data

This folder will give you the complete facts on the Sundstrand Magnetic Coolant Separator. Write for your copy today. Ask for bulletin 383-M.

SUNDSTRAND POWER-GRIP ®

SUNDSTRAND
Magnetic Products Co.
Division of Sundstrand Machine Tool Co.
1020-9th ST. • ROCKFORD, ILLINOIS

Use postpaid card. Circle No. 264

P. L. Smith, Bryant Gage and Spindle Div.

J. N. Howlett, Morrison Products

J. W. Browder, Western Design

I. W. Peterson, Norton Co. Detroit Manager

Prentiss L. Smith has been appointed to the newly created position of sales manager of spindles for the Gage and Spindle Division of Bryant Chucking Grinder Co., Springfield, Vermont.

John N. Howlett, has been appointed manager of the Wheel Guard Division of Morrison Products, Inc., Cleveland. Howlett will be in charge of sales, interpreting safety code regulations and spear-heading product improvement.

James W. Browder has been named sales manager of Western Design & Manufacturing Corporation of Santa Barbara, California, designers, engineers, and manufacturers of electro-mechanical and electronic equipment for the aircraft and missile industry.

Irwin W. Peterson has been appointed Detroit district manager of Norton Company's Grinding Machine Division. He succeeds **Clarence L. Smith** who has retired after a career of 34 years with the Division. Peterson first joined the company in 1933 as a planning clerk. He later served as an assistant foreman, methods engineer, and sales engineer at the company's main office in Worcester, Mass. He was appointed District Sales Engineer in Michigan in 1950.

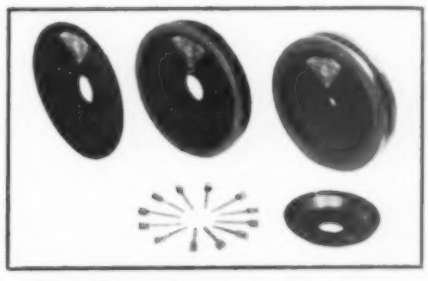
Promotions in the finance and engineering divisions of The Carborundum Company have been announced. **George J. Zimmerman,** formerly director of engineering, and for the past two months acting controller-treasurer, was elected controller. **Gilbert J. Stewart,** former assistant treasurer, was elected treasurer. **Earl Wilson,** formerly acting controller of the Bonded Abrasives Division, was elected assistant controller. **Carl B. Wille,** formerly manager of the vitrified project development of the Bonded Abrasives Division, was appointed Director of the engineering division of the functional staff reporting to the president.

Walter E. Spieth, previously Manufacturing Vice President of Reo Motors, Inc., at Lansing, Mich., has been named Master Mechanic of Coote & Jorgensen, Ltd., Australian subsidiary of Borg-Wagner Corp.

Joseph C. Drader, a vice president

SIMPLE LOCKING AND SEPARATING DEVICE is being successfully used by The Timken Roller Bearing Company in the handling of its large finished bearing cups. Device makes it possible to stack one large cone on top of another without danger of slipping. A sudden stop or quick turn without the clamps in place could cause the heavy cones to slip off the skid due to the smooth surfaces of the front and back faces.

LEADER IN THE DIAMOND WHEEL AND DEVELOPMENT FIELD



"Ace of Diamonds" brand diamond wheels your assurance of the best in high quality diamond wheels.

For longer life, cooler cutting and economy of operation, Ace of Diamond Wheels are the answer to your grinding problems.

Quality assured and maintained—through modern facilities and rigid standards.

Products of over 30 years experience

Manufacturers of:
Resinoid—Metal—Vitrified Diamond Wheels
Powdered Metals—Allied Products

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271-279 GROVE AVENUE VERONA, N. J.

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PRECISION DIAMOND TOOLS

Industrial Diamonds
Thread Grinders
Turning Tools
Engraving Tools
Dressing Tools
Diamond Powder

Manufacturers of
DIAMOND TOOLS
and
WHEELS

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CLEVELAND, BILL WIESE, 8905 Lake Ave.
DETROIT, FLOYD BEARSS, 1433 Northwood Blvd., Royal Oak, Mich.
INDIANAPOLIS, IVAN STRANGE, 33 Tyler Ave., Greenfield, Ind.
PHILADELPHIA, H. J. MILLER, Valley Brook Rd. and Glen Mawr Dr., Ambler, Pa.
ROCHESTER, N.Y., DON GINEGAW, 10 Oak Manor Lane, Pittsford, N.Y.
SYRACUSE, N.Y., BARNES & JORDAN, INC., 409 E. Jefferson St.

Representatives in Principal Cities

CLIPPER DIAMOND TOOL CO., INC.

345-E HUDSON ST. NEW YORK 14, N.Y.
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NEWS OF INDUSTRY *continued*

of Michigan Tool Company, Detroit, has retired. Drader has headed the company's research work in gear development.

James F. Connaughton has been elected to the new post of executive vice-president of Wheelabrator Corporation, Mishawaka, Indiana. **Harold M. Miller,** who has been a vice-president since 1944, was advanced to senior vice-president. **Jacob A. Schmidt, Jr.,** treasurer since 1952, is now secretary-treasurer. **John M. Wolf,** assistant treasurer since 1955, was appointed controller. **Edward T. Sullivan** was appointed assistant secretary-assistant treasurer.

Thomas Atkins has been appointed sales supervisor, Coated Abrasives Division, Armour and Company, Alliance, Ohio. He will supervise sales in Northern Illinois.

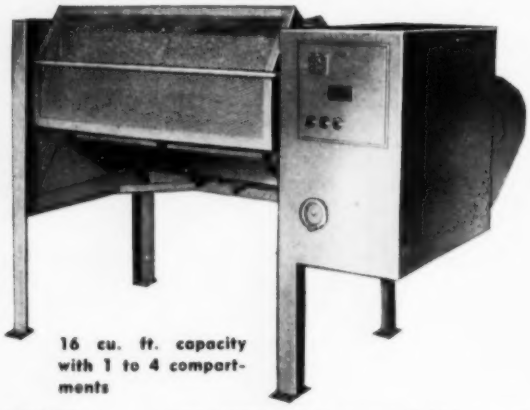
Whitney Collins, who has been associated with the Continental Aviation and Engineering Corporation, will join Solar Aircraft Company as executive assistant to the president.

Left, A. G. Galler; right, W. J. Scott, Norton appointees

Norton Company has assigned two recent graduates of the sales training course. **Albert G. Galler** has been appointed a field engineer at the Teterboro, N.J., district office and **Winfield J. Scott** becomes an abrasive engineer at Chicago.

Henry R. Hansen has recently been appointed representative in the states of Colorado and Utah by The Cushman Chuck Company, Hartford, Connecticut.

NEW HEAVY-DUTY BARREL FINISHING MACHINE SPEEDS PARTS OUTPUT



16 cu. ft. capacity with 1 to 4 compartments

FEATURES

- **Direct belt and gear drive without chains and sprockets. Variable speed 8 to 25 rpm.**
- **Interchangeable barrels to fit any desired compartment make-up.**
- **Rugged, heavy-duty construction; No-Seam Vinyl-lined barrels.**

USE MODEL V-16. Speed finishing work. Cut parts handling costs on small lots or continuous runs. Select individual barrel sizes to fit any desired combination of compartments. The V-16 Precision Barrel Finishing machine has many versatile features to meet your specific needs, assuring maximum output at lower cost. Engineering design is outstanding.

FULL DETAILS are available in new catalog data sheet "V-16". Write for your copy today.

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BARREL FINISHERS • SCREEN SEPARATORS • COMPOUNDS • NYLASLUGS

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for Super-Finishing of

HARDENED STEEL
CERAMICS
CARBIDE
STELLITE

SUPER-LAP

DIAMOND COMPOUND

Now you can get high-luster, micro-finishes in less time . . . at less cost. Acme Super-Lap is pure diamond, accurately graded and uniformly suspended in a quality, water soluble vehicle that adheres to the work surface. Applicator simplifies use, operates with one hand.

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Acme Scientific Company

1460 W. RANDOLPH ST. • CHICAGO 7, ILLINOIS
MONROE 6-1834
World's Leading Mold Polishers

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Frank F. Oddi has been promoted to controller of the Bonded Abrasives Division of The Carborundum Company.

Eugene Krystopolski and **John Dinovo** recently entered the Maytag company's engineering and manufacturing training program, designed to familiarize trainees with the functions and organization of the company's engineering and manufacturing departments prior to their assignment to positions in these departments.

D. B. Ladd, UBS Chemical

S. S. Krentel, MacDermid Inc.

Donald B. Ladd has been named to the staff of UBS Chemical Corporation of Cambridge, Mass. to establish a commercial research department. He will undertake extensive studies of marketing new products manufactured by UBS Chemical Corporation.

Stanley S. Krentel, vice-president of MacDermid Western, has been named Executive Vice-President of MacDermid Incorporated.

R. F. Reid, Arter Grinding Machine

T. F. Mummery, Besly-Welles

Robert F. Reid has assumed the position of Sales Manager for Arter Grinding Machine Company, Worcester, Mass. Reid will administer all phases of domestic and foreign sales policies, distributor relations, and supervision of service for the complete line of Arter precision machine tools.

Theodore F. Mummery Jr., has been appointed to the new post of Manager of Cutting Tool Sales for the Besly-Welles Corporation. He has been transferred to Besly's factory and general sales office at South Beloit, Illinois.

The Gisholt Machine Company, Madison, Wisconsin, recently announced the election of **George M. Class,** as a new general officer to the board of directors.

G. M. Class, Gisholt Machine Co.

Lawrence Abbott, Engelberg Huller Co.

Class, also vice president of engineering, has been with Gisholt for more than 30 years.

Lawrence Abbott has been appointed West Coast sales engineer by Engelberg Huller Company. Abbott's territory will include Washington, Oregon, California, Nevada, Idaho, and Arizona.

John E. Taylor has been appointed an abrasive engineer for the territory in the Toledo, Ohio area by Norton Company. He was formerly a field engineer assigned to the Cleveland district office.

The abrasives division of Elgin National Watch Company announces the appointment of **William E. Burgoyne, Jr.,** as sales engineer in its New York City area.

Appointment of **Carl O. Larson** as superintendent of the Machine Division of Moore Special Tool Company, Inc., Bridgeport, Connecticut, to succeed **Hadar Wahlquist,** who is retiring, has been announced.

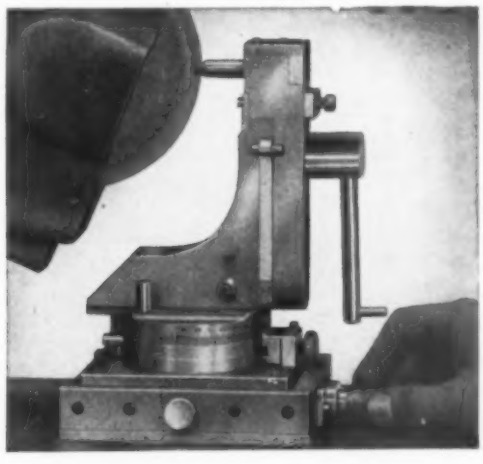
Tough Grinding Wheel Forms Dressed Easy as A, B, C

eliminate elaborate set-ups and operations

.0001" ACCURACY

Fluidmotion
WHEEL DRESSERS

dress two angles tangent to a radius in one continuous motion



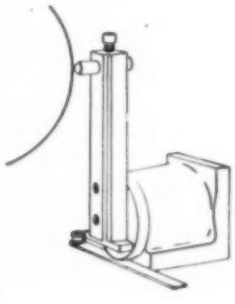
With the unique "Fluidmotion" Dresser, you can dress two angles tangent to a radius — using one handle in one continuous motion. Operation is so fast and simple that beginners can use them.

Adaptable to all type cylindrical and surface grinders.

A. Obtain micrometer reading; add required convex radius or subtract required concave radius.

B. Loosen jib with wrench and "mike" over lower pins to reading obtained above.

C. Tighten jib. Set stops for two angles. Ready for action.



Also available: "FORM MASTER" Dresser, capable of dressing any radii up to 12" convex, up to 15" concave.

See your industrial distributor or write for free literature.

J&S TOOL CO. INC. — WHEEL DRESSERS · SAW CLAMPS · PRECISION VISES · DOWN-HOLDING DEVICES

CLAMPCUT

J & S TOOL CO., INC.

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THE GREATEST AID TO MICRO-FINISH GRINDING EVER DEVISED

By using DIA-CHROME CO. LUBE STICK on all types of finish grinding wheels, whether aluminum oxide, silicon carbide, even the finest diamond wheels, you will obtain the maximum performance on all metals, ferrous or non-ferrous.

This lube stick can be used in addition to your present oil-emulsion coolants or mist sprays. You cannot throw it off the wheel.

These are the benefits immediately apparent:

MICRO-FINISH
COOLER GRINDING
LONGER WHEEL LIFE
LESS WHEEL DRESSING
PREVENTS LOADING.

When wheel becomes packed with lubricant and metal dust, just wash with soft brush and kerosene. Directions for use printed on wrapper.

Nationally priced at $2.50 each.

DIA · CHROME CO.
Reg.
Diamond Coated Steel Tools
722 S. VERDUGO ROAD
GLENDALE 5, CALIF.

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NEWS OF INDUSTRY *continued*

G. H. Rearick, Babcock & Wilcox

F. J. Keller, Vermont Tap and Die

Fred Voss, Chainveyor Corp.

Ellis Jeffers, Chainveyor Corp.

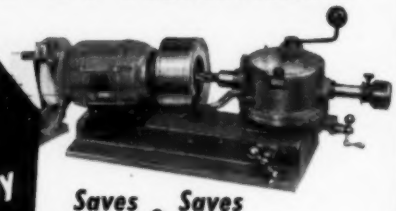
Glen H. Rearick, member of the vice president's staff and former manager of two plants of The Babcock & Wilcox Company's Tubular Products Division has retired.

Frederick J. Keller has been named sales director for Vermont Tap and Die Company, manufacturer of taps and dies. Keller has previously been associated with the Cadillac Division of General Motors and most recently as Vice President and Director of Midwest Tool and Cutlery Company.

Fred Voss, former assistant sales manager of the Samuel Olson Conveyor Company, will take over as manager, Chainveyor Corporation district No. 2, which covers the mid-western states with headquarters in Chicago, Illinois. Voss replaces **William Schilling** who returns to Los Angeles engineering office. **Ellis Jeffers,** who recently resigned as sales manager of Rapistan Keystone Division of Rapids-Standards Company, will head Chainveyor's district No. 3 which is comprised of Michigan, Ohio, Western Pennsylvania and Western New York with headquarters in Detroit, Michigan.

***Super* MULTI-SPIRAL END MILL GRINDING FIXTURE**

SHARPENS END MILLS Quickly... Completely IN YOUR OWN SHOP



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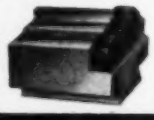
For grinding or milling of any spiral lead. Pays for itself in a hurry. Send for facts today.

SPIRAL SPECIAL CUTTING TOOLS
Cut Operations 75% or More!

Custom-designed, precision made, exactly to fit your needs. Boost both output and quality. Ask for details.



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Designers and Manufacturers of All Types of Special Cutting Tools
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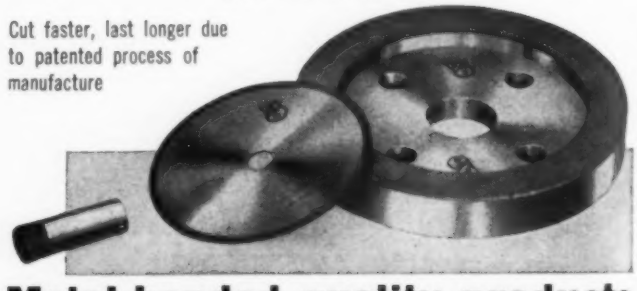
STEELSET
SINTERED STEEL BOND
DIAMOND WHEELS
(FOR WET GRINDING)

Cut faster, last longer due to patented process of manufacture



Metal-bonded quality products
In standard and special sizes and shapes for:

OPERATIONS	MATERIALS
Grinding	Sintered carbides
Electrolytic Grinding	Sintered oxides
Honing, Lapping	Ferrite
Slicing, Dicing	Germanium, Silicon
Drilling	Glass, Quartz
Reaming	Marble, Granite
Generating	Ceramics, Porcelain
Pencil edging	Sapphire
Chamfering, Beveling	Boron carbide
Grooving	Cermets

We specialize in NON-STANDARD requirements.
Send us your prints for quotation.
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Fish-Schurman Corp., 81 Portman Road, New Rochelle, N.Y.

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For increased output and accuracy, finish your tools and gages with HYPREZ DIAMOND COMPOUNDS

Virgin Diamond particles, graded in our own laboratories, are uniformly dispersed in the exclusive Hyprez vehicle for maximum cutting action. They produce finer results faster on every finishing job... Your nearby Hyprez distributor will help you solve any lapping or polishing problem that may arise.

Write for free demonstration or technical bulletin No. HG-97

HYPREZ DIVISION
ENGIS EQUIPMENT CO.
431 S. Dearborn St., Chicago 5, Illinois

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Mark Jehn, Joseph T. Ryerson

Gail Stifler, Clearing Machine Corp.

The appointment of **Mark Jehn** as general claim manager for Joseph T. Ryerson & Son, Inc., has been announced. He formerly was manager of the claim department at the company's Chicago plant and succeeds **George W. Hooper,** retired.

Gail Stifler, Clearing Machine Corporation district sales representative, has been transferred from the company's Philadelphia sales area to the New York-New England area.

Arthur R. MacNeil, New England Sales Manager for MacDermid Incorporated, Waterbury, Connecticut, has been named vice-president of the company. MacNeil will continue as New England Sales Manager along with his new duties as Vice President.

J. Edouard Sauvè, who has represented Oakite Products, Inc., in Marion, Ohio, for the past five years, joins the Detroit staff and will serve the metal industries in the northeastern metropolitan area. **Peter J. Texier, Jr.,** since 1952 a member of the technical staff of Oakite's service laboratory, has been assigned to serve the metal industries in south Buffalo, New York.

John R. Lenox, formerly an administrative official of Minneapolis-Honeywell Regulator Company, has been elected vice president in charge of operations, of Datamatic Corporation of Newton Highlands, Mass., wholly-owned subsidiary of Honeywell.

Richard L. Rouviere was recently appointed to the position of Market Extension Engineer by Devcon Corporation, Danvers, Mass.

John G. Kearns has been appointed production manager of Lord Chemical Corporation, York, Pa., manufacturer of equipment and compounds for precision barrel finishing of metals and plastics.

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dependence on imported tin and natural rubber, or as atomic power may replace coal and oil. Similarly, synthetic products made from renewable resources may serve as substitutes for irreplaceable materials.

"Perhaps we need brain power most to teach us the folly of needlessly wasting the inheritance of our children. Using irreplaceable materials resources is like using up your capital instead of learning to live on your interest or earnings. No matter how slowly we deplete capital, the day must come when we have nothing to leave our descendants. For almost two centuries we have been wasteful because we thought our natural resources were inexhaustible.

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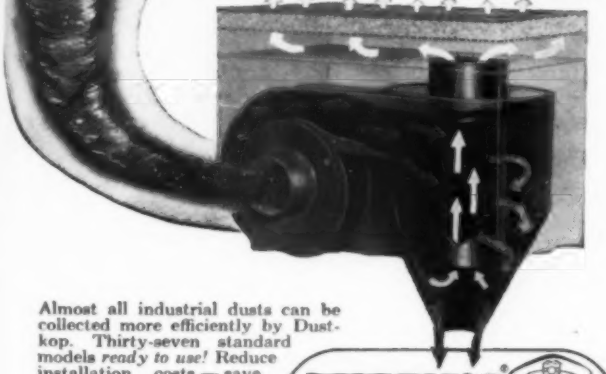

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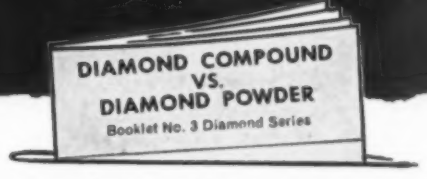

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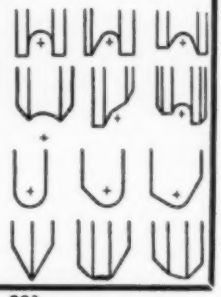

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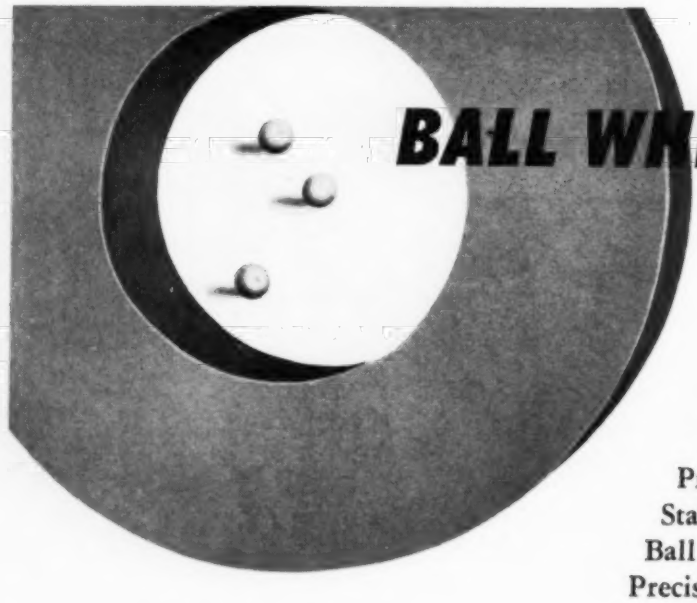

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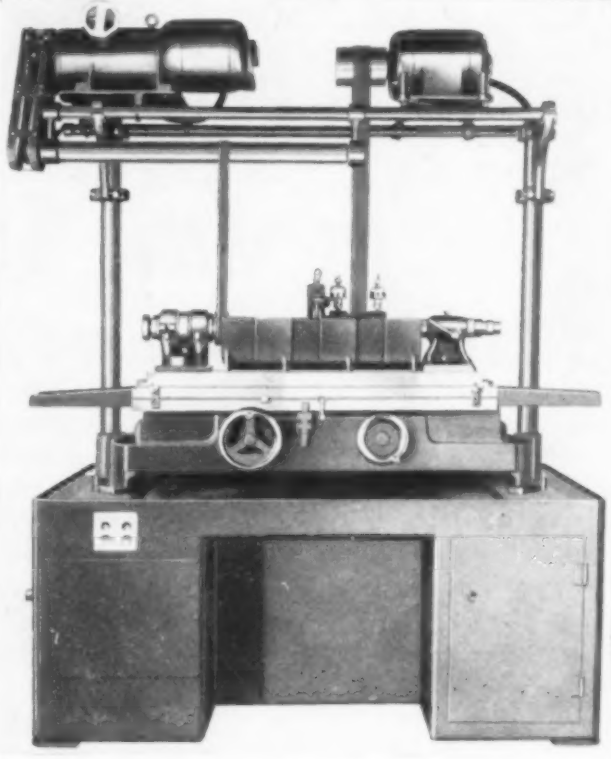

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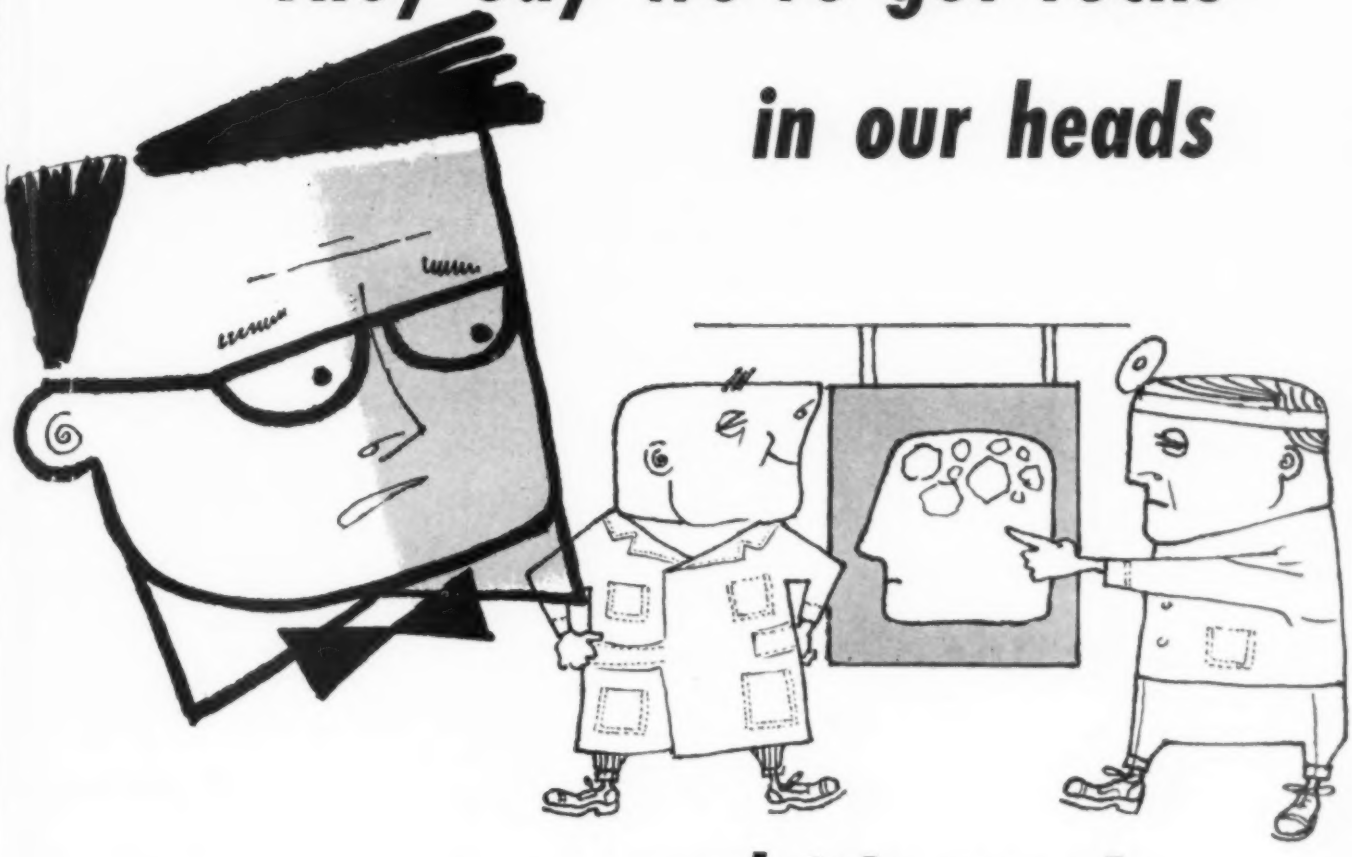

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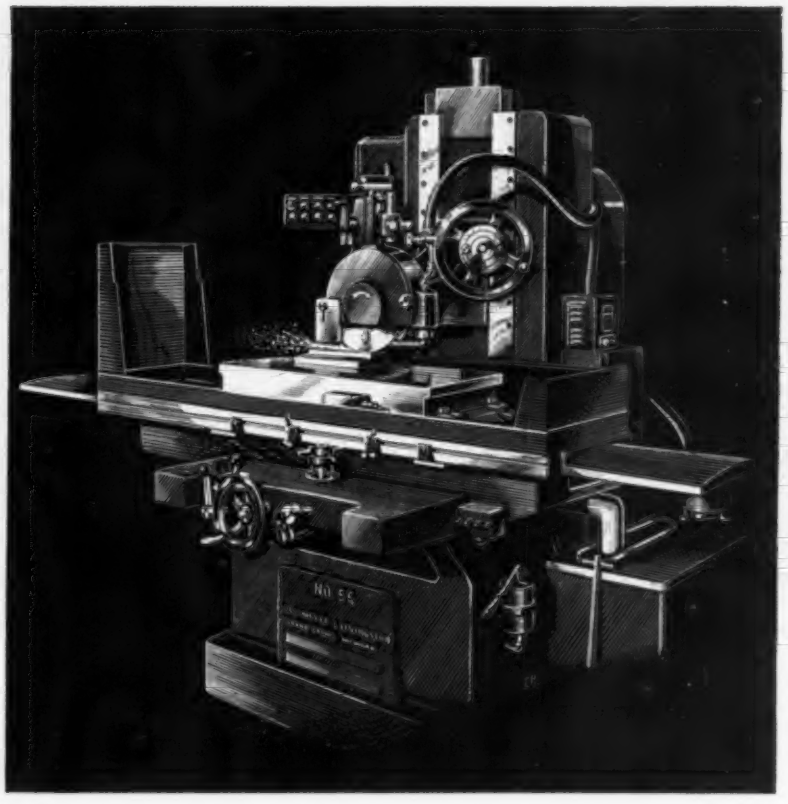

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Photos: Courtesy The Timken Roller Bearing Company, Canton, Ohio

e.g. roller bearing races

Unusual accuracy is required in the manufacture of tapered-roller bearings. That's why The Timken Roller Bearing Company, leading producer of tapered-roller bearings, uses Erickson precision expanding mandrels for rough and finish grinding of roller bearing races. For in addition to their ability to hold to closest tolerances consistently, they have instantaneous release feature that speeds loading and unloading—for real production dividends.

Let an Erickson representative show you how Erickson precision expanding mandrels can solve your grinding problems. AA-2451

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Closeup of Erickson precision expanding mandrel as used by Timken®. In special application illustrated, Erickson mandrels can hold one ten-thousandth of an inch (.0001") concentricity.

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